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Selected review of state natural heritage inventories with recommendations for Montana

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A SELECTED REVIEW
OF STATE NATURAL HERITAGE INVENTORIES
WITH RECOMMENDATIONS FOR MONTANA

By

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Chapter 1

INTRODUCTION

This study has been undertaken with an objective to: 1) review the experiences of a selected group of states with natural heritage inventories; 2) examine the respective needs of the departments of Montana State government that share an interest in natural heritage inventory development; and 3) recommend what form of natural heritage inventory the state of Montana should develop.

A first priority is to define, for the purpose of the study, the meaning of natural heritage. With an understanding of what natural heritage comprises, I can proceed to describe the evolution of the natural heritage inventory, examine state experiences, and finally focus on the Montana situation.

A literal translation of natural heritage yields, at best, a definition of questionable value. Using Webster's New International Dictionary, we learn that heritage is "something transmitted or acquired from a predecessor; legacy." Interpreting the associated definitions of nature and natural, relative to heritage, natural heritage translates "features existing in the external world in its entirety that are transmitted or acquired from a predecessor." With such an all-inclusive definition, it is no surprise that those agencies, private organizations, and individuals that are directly concerned with natural heritage conceptualize the phrase in a narrower sense.

Natural heritage is widely regarded as existing plant and animal species, their aquatic and terrestrial habitats, the ecosystems they comprise, and unique geological features of the environment. As constructed, this definition provides an adequate working description of natural heritage. The distinction is made between natural heritage consisting primarily of biological and geological features and cultural heritage which includes historical and archaeological features. Preexisting use and misuse of the phrase natural heritage precludes any definitive answer to the question of exactly what it constitutes. For example, the state of New Mexico considers paleontological features part of its natural heritage, while the Washington Natural Heritage Program deemphasizes geological features. The definition presented above will be understood in its broadest sense and consequently allowed to accommodate varied interpretations.

While there exists some disagreement over what features constitute natural heritage, the fact remains that, as heritage, the features are transmitted or acquired from a predecessor. The transmittance of natural heritage has proceeded passively over the millennia. Only recently have people assumed a purposeful role in considering the quantity and quality of natural heritage available for future generations. One facet of this role has been the creation of natural heritage inventories.

In one respect, these inventories represent the continuing preoccupation humankind has demonstrated with classifying and collecting natural objects in the environment. Some 2,350 years ago, Aristotle pondered how organisms might be meaningfully grouped and order brought

to the great diversity of living things. Darwin on his journeys went about systematically collecting specimens for later study. Great herbaria and museums have become established through centuries of plant and animal collection. Human perception now recognizes the need for additional inventories, those of natural features as they exist in the natural environment. Such inventories are needed to establish a new collection--one of plants, animals, and other unique features--protected among undisturbed habitat. To this effect, natural heritage inventories have been created. To understand their nature and function, an examination of the historical evolution that has led to a demand for these inventories is needed.

Chapter 2

EVOLUTION OF THE NATURAL HERITAGE INVENTORY

Background

Man's awareness of his natural heritage has developed after centuries of altering it through the use of existing natural resources. Sargent (1972) has defined natural resources as:

> . . . the materials and capacities of the environment that are useful to man. Broadly defined, these resources include land and water, plant and animal life, mineral reserves, aesthetic qualities, and other geophysical characteristics of the earth.

Increasing human populations and increasing individual desires have been imposing greater demands on the ecological systems that fulfill the food, fiber, and aesthetic needs of mankind. If these demands were modest and their rate of increase small, natural systems would have the resilience or stability to absorb considerable punishment. They have, after all, evolved in the face of natural fluctuations and catastrophes before humans appeared (Sanders, 1978).

There are, however, several indications that human demand on the environment has not been modest. As a cultural geographer and anthropologist, Carl Ortwin Sauer wrote extensively scrutinizing the full historical record of man on earth. He saw man as a highly selective appraiser of resources and a highly selective modifier of nature. He discerned that during the Pleistocene Epoch, climate was the first and man the second great "agent of disturbance" (Speth, 1977). With the

exceptions of overgrazing in the dry interior of the Old World and land degradation in the Mediterranean, Sauer felt that the most significant record of destructive exploitation of natural resources was the period of modern history during the transatlantic expansion of European commerce, peoples, and governments. Regardless of its relative ranking, the profound impact of America's early expansion on its natural resource base is undisputable.

The hardest hit resources were timber and wildlife. Millions of acres of forest were cleared for cropland and to provide lumber for construction. Large populations of wildlife such as the passenger pigeon, the fur seal, and the American buffalo were slaughtered for sport and profit. Carl Sauer has commented that as a population applies its skills and values to an area it occupies, it initiates a deformation of the prehuman landscape that increases with "length of occupation, growth in population, and addition of skills" (Speth, 1977). The current situation in the United States certainly reflects Sauer's thoughts.

In 1975 the Council on Environmental Quality estimated that 1.25 million acres were being converted annually from natural and agricultural uses to more intensive uses (Metcalf and Sebelius, 1978). In one five-year period, 4.6 million acres of American land were transferred to urban and transporation use. Such disturbance has left many states with virtually no lands retaining their natural character. In Ohio 99% of the original landscape has been altered (Metcalf and Sebelius, 1978). In Illinois it is estimated that only .07% of the total land area can be classified as undisturbed (Schwegman, personal communication, 1979). Iowa evidently does not contain a single acre of land that has escaped

man's impact. Incidentally, there is not a single place in the state greater than a mile from a public road (Priewert, 1978).

Peter Marks (1978) of Cornell University reviewed, during his testimony on the Natural Diversity Act of 1978, the changes that have occurred in the American landscape during the 200 to 300 years since European settlement. He noted that some changes from natural to managed communities have been beneficial. One obvious benefit has been the increased production of agricultural and forest products. The conversion of forest to agricultural land has also had an aesthetically pleasing impact in that "today's landscape is more open and in many areas more heterogeneous than was the original heavily forested landscape of much of the United States." However, Marks continued by examining the negative aspects: the disturbance of natural ecosystems and destruction of habitat that has undoubtedly accelerated the extinction of native species.

Robert Jenkins (1976) has estimated that this disturbance has reached a magnitude where one-half of the nation's topsoil has been lost, 90% of the tall grass prairie plowed, 30% of eastern salt marshes destroyed, and over half of the interior wetlands drained. In the state of Tennessee, two years of research were required to locate good examples of only 72% of the 132 native plant communities. Of 7 million acres of wetlands originally in Wisconsin, only 1.5 million remain (Metcalf and Sebelius, 1978).

The disturbance of natural communities and habitats has been accompanied by an increase in extinction rates of native species. It is estimated that 500 extinctions of plant and animal species have occurred in North America since 1600 (Metcalf and Sebelius, 1978). Presently 10%

of the 22,000 native plant species of the continental United States are listed by the Smithsonian Institution as being "endangered" or "threatened" (Ayensu and DeFillipps, 1978). Worldwide, it was estimated that between 1600 and 1950 an average of one animal species or subspecies per decade became extinct. The International Union for the Conservation of Nature and Natural Resources now estimates that one species or subspecies is lost each year. This rate can be compared to the "great dying" of the dinosaurs when an average of one species per every thousand years became extinct (Eckholm, 1978).

Human impact can no longer be considered equivalent to the non-human natural processes that lead to landscape modification and species extinction. As a habitat is modified, a geological feature destroyed, or a species extirpated, the natural diversity of the environment diminishes. Diversity is broadly defined as "the condition of being different or having differences" (Gove, 1969).

Several concerns have been articulated in recent years on the potential detrimental effects of reduced natural diversity. These concerns are pertinent to this study, for they have precipitated various efforts to preserve the remaining biotic and geologic features of our natural heritage, including the development of natural heritage inventories.

The Significance of Natural Diversity

The need to preserve natural diversity has been addressed in numerous studies (Darnell, 1973; Ehrenfeld, 1972; Humke et al., 1975; Jenkins, 1976; Leopold, 1949; Metcalf and Sebelius, 1978; Myers, 1977;

The Nature Conservancy, 1978a). A comprehensive review of this work is unnecessary; a brief summary of the salient points will supplement appreciation of natural heritage inventory development.

As an integral characteristic of natural heritage, diversity is valued for both its utilitarian potential and aesthetic contribution to man. First, let me address the question: How is natural diversity useful to mankind?

The natural diversity of species and the communities they comprise constitute a substantial genetic resource. Modern agricultural practices are dependent on the continuing development of crop monocultures from the genetic base of wild progenitors. Ancestral strains of wheat, rice, and barley have been nearly eliminated throughout their native habitats in Europe and Asia. Agricultural scientists have repeatedly expressed concern over the loss of genetic diversity in nearly every major crop species (Humke et al., 1975). Of the 80,000 edible plants thought to exist on this planet, only 50 have been cultivated to any major extent (Myers, 1977). Conceivably, plant species that have been disregarded in the past could become widely utilized. Furthermore, advances in biochemistry and molecular biology have opened the possibility of genetic complements of species being manipulated to enhance productivity. While future demand for additional food species is unknown, recognition that a high demand is likely dictates that high plant and genetic diversity be maintained today.

Preserving plant and animal diversity constitutes a genetic resource for medicine and pharmaceuticals. Analgesics, antibiotics, cardioactive drugs, enzymes, hormones, anticoagulants, narcotics,

vitamins, and antileukemic agents have been derived from plant and animal substances (Myers, 1977).

Current research continues to discover new uses of compounds found in plant and animal species. Only 5% of all plant species have been evaluated for the presence of pharmacologically-active substances (Myers, 1977). Certain species of *Lesquerella* and *Lemnathes* have recently been found to contain oils with great industrial potential (Humke et al., 1975). The value of a species can change dramatically once a medicinal use is discovered; *Penicillium* fungus is but one example. The point is that species containing substances of which the worth is not yet appreciated should not be discounted.

Scientific research benefits from the preservation of natural diversity. Natural areas (those areas not affected to any great degree by man or man's activities) provide ecological research study sites, baselines for research on impacted lands, and opportunities for environmental monitoring of pollution. Type habitats and ecosystems are as valuable to ecologists as type specimens are to botanists (The Nature Conservancy, 1978a). When paleontological sites, geologic formations and soil types are considered part of an area's natural heritage, the diversity contained within these features offers significant potential for scientific research and education. Educational value is, of course, present among all features of natural heritage.

Natural diversity may contribute to the stability of ecosystems. Biologists define diversity as species per unit area. The significance of diversity is widely debated (Brookhaven Symposia in Biology, 1969). It is generally agreed that greater diversity promotes increased

community stability or the capacity to resist changes imposed by external or internal factors (Ricklifs, 1973). Exceptions to this premise exist in the natural monocultures of braken, sargasso (Red Sea), and the grassy marshlands of the East Coast of the United States (Myers, 1977). Furthermore, several mature, climax communities contain less diversity than their respective successional stages. Stability is in itself a widely misunderstood concept. Frank Preston (1969) writes:

> Whatever stability there is in the ecological world is not a static equilibrium, but a fluctuating or dynamic one, and normally a highly fluctuating one. Stability lies in the ability to bounce back, not in the ability to hold tenaciously to ground once taken or numbers once achieved.

Preston cites numerous examples of species whose populations fluctuate wildly from near extinction to plague proportions, but remain remarkably persistent through time. Therefore, the role of diversity in the function of ecosystems is controversial. If for no other reason, preserving the various elements of ecosystem diversity permits the ongoing study of this phenomenon.

Having reviewed the utilitarian values of natural diversity preservation, the aesthetic contributions should be considered. Jenkins (1976) states the belief that:

> . . . human beings have psychological needs for association with, or stimulation by, diverse natural landscapes. This psychological symbiosis may be obligate or simply enriching. Nearly any enjoyable human activity has a strong component of diversity, and the opposite situation is boredom or monotony. Even if we determined that natural diversity was only a psychological luxury, it would still seem well worth having.

This viewpoint needs little clarification. Geologic features that have been considered natural heritage (lava flows, hot springs, caverns, volcanic calderas, etc.) contribute to the diversity of landscapes one

can experience. The fact that people are stimulated by diverse natural landscapes demonstrates the additional value of conserving these landscapes and properly managing them for recreation and tourism.

In conclusion, diversity within our natural heritage offers many practical uses to humankind. Furthermore, the current condition and trends of American land use indicate that natural diversity is diminishing. Natural heritage inventories have evolved as a means of cataloging the remaining components and mapping their locations. The events and actions that have contributed to developing these inventories are the next subject of concern.

Evolution of the Natural Heritage Inventory

Depletion of natural resources in the middle of the 19th century resulted in a shift in attitude in the United States about the policy of disposing lands out of public ownership. It appeared that the only way to prevent the complete depletion of timber and wildlife was to retain or regulate the disposal of public lands (The Nature Conservancy, 1978a).

Henry David Thoreau, John Muir, George Perkins Marsh, and Frederick Law Olmsted contributed to a growing movement for land preservation. George Marsh (1864) wrote:

> It is desirable that some large and easily accessible region of American soil should remain, as far as possible, in its primitive condition, at once a museum for the instruction of the student, a garden for the recreation of the lover of nature, and an asylum where indigenous tree . . . plant . . . beast, may dwell and perpetuate their kind.

A positive attitude towards preservation prevailed in the United States during the last half of the 19th century. Yosemite Valley and the Mariposa Big Tree Grove were designated a California State Park in 1864,

Yellowstone National Park became the first permanent land reservation created by Congress in 1872, and in 1890 Congress created three additional parks: Yosemite National Park, General Grant National Park (later incorporated into Kings Canyon National Park), and Sequoia National Park (The Nature Conservancy, 1978a). The Forest Reserve Act of 1891 empowered the President to create "forest reserves" by withdrawing land from the public domain. By 1908 more than 194.5 million acres had been withdrawn and designated forest reserves. At that time, the Act was amended to prohibit further presidential land withdrawals through the efforts of western congressmen (Robinson, 1975).

If we examine the purpose behind resource preservation prior to the early 1900's and efforts that were to follow, we recognize a distinction significant to the evolution of the natural heritage inventory. The designation of National Parks and Forest Reserves (later to become National Forests under the Forest Service) were aimed at preserving specific resources to assume a continuing supply. Spectacular scenery and wilderness provided recreation potential within the National Parks while vast forests provided a continuing supply of timber from the Forest Reserves. The first suggestion that preservation may have other purposes came from Aldo Leopold, who joined the Forest Service's New Mexico district in 1909. In succeeding years he advocated that wilderness contained value for wildlife management and scientific research, besides the established uses. Leopold's work directly influenced the first withdrawals of land for the explicit purpose of preserving their natural character. Preserving natural character would be the theme of future natural area programs and, eventually, the natural heritage inventory.

In 1920 the Trapper Lake area in Colorado was withdrawn to be protected in its primitive state, and the Gila Wilderness in New Mexico was established in 1924 (Moir, 1972).

Occurring simultaneously with Leopold's work was what could be considered the first attempt at inventorying America's natural heritage. In 1917 the Ecological Society of America formed the Committee for the Preservation of Natural Conditions to inventory the areas in North America that remained in natural condition (Humke et al., 1975). The committee worked seven years, supported by the National Research Council, the Forest Service, public agencies, and professional societies, before publishing in 1926 its report Naturalist's Guide to the Americas (Romancier, 1974). The committee was reorganized in 1946 as the Ecologist's Union and evolved into The Nature Conservancy in 1950 (Humke et al., 1975).

The Forest Service established the first system of natural areas in America, designating a ponderosa forest on the Coronado National Forest of Arizona as a Research Natural Area in 1927. A Research Natural Area is established for scientific research and is defined as a "naturally occurring physical or biological unit where natural conditions are maintained insofar as possible" (Dyrness et al., 1975). The Research Natural Area program is currently affiliated with the Federal Committee on Ecological Reserves (discussed below) with the common objectives:

1) To assist in the preservation of examples of all significant natural ecosystems for comparison with those influenced by man;

2) To provide educational and research areas for scientists to study the ecology, successional trends, and other aspects of the natural environment;

3) To serve as gene pools and preserves for rare and endangered species of plants and animals (Federal Committee on Research Natural Areas, 1968).

As of July, 1975, 117 Research Natural Areas in 30 states and Puerto Rico had been established by the Forest Service (The Nature Conservancy, 1978a).

Other public and private agencies initiated natural area programs as a means of preserving natural diversity. National programs were developed by several professional societies including the Society of American Foresters (1947), the Society for Range Management (1966), and the Soil Conservation Society of America (1968) (Romancier, 1974).

The state of Wisconsin established a Scientific Areas Preservation Council in 1951 to recommend acquisition of specific scientific areas, maintain a published list of scientific areas, recommend sites for federal designation, and determine the desirability of donated lands for preservation purposes. A Wisconsin Scientific Area is a formally dedicated natural area. Similar comprehensive state programs that have jurisdiction over all natural areas within the state (as opposed to only those administered by one agency) presently exist in 25 states (The Nature Conservancy, 1978b).

Two major federal programs concerning natural areas were initiated in the 1960's--the Federal Committee on Ecological Reserves and the National Natural Landmarks Program. The National Natural Landmarks Program was administratively created within the National Park Service by the Secretary of the Interior in 1962. The program established a National Registry of natural sites that are of national significance and not on lands presently under National Park Service jurisdiction. While registration is voluntary and does not change ownership or development

rights, the objective of the national registry is to:

1) Encourage the preservation of sites illustrating the geological and ecological character of the United States,

2) Enhance the educational and scientific value of sites thus preserved,

3) Strengthen cultural appreciation of natural history, and

4) Foster a wider interest and concern in the conservation of the Nation's natural heritage (Office of the Federal Register, 1975).

A list of "themes" or broad categories of natural history has been developed by the Park Service for regional implementation of the Landmark Program. Ecological and geological sites are selected by regional scientific teams under a contractual arrangement with the Department of Interior. Sites are selected to assure complete representation of the themes present in each designated natural region (physiographic province). As of 1975 there were 396 sites listed on the National Registry, with two to three thousand sites anticipated once all regional studies and field checking are completed (The Nature Conservancy, 1978a).

The Federal Committee on Ecological Reserves was founded in 1966 as an inter-agency coordinating body for the establishment within the United States of a comprehensive system of protected research reserves. This program represented the United State's participation in the conservation of ecosystems section of the International Biological Program (IBP) initiated in 1964 by the International Council of Scientific Unions. The Committee is presently sponsored by the National Science Foundation and the Council on Environmental Quality (Darnell, 1976). It is not recognized as an official federal agency as such; however, 19 federal agencies are represented on the Committee. The efforts of the group were

focused during the IBP (1964-1974) towards publishing a directory of existing research natural areas in the United States. This task was accomplished by the publication of the Directory to Research Natural Areas on Federal Lands of the United States of America (1968). The Forest Service had an existing Research Natural Area program; other federal agencies including the National Park Service, Bureau of Land Management, Fish and Wildlife Service, Department of Defense, and Energy Research and Development Commission were stimulated by the Committee to initiate programs or update existing efforts. The Committee has been hampered by the absence of sufficient funding, but efforts are continuing to update the Research Natural Area directory and develop a data storage system for the sites (The Nature Conservancy, 1978a).

In addition to the wide array of federal and state natural area activities, The Nature Conservancy, as a private, national conservation organization, has made a significant contribution in preserving America's natural diversity. The Conservancy was incorporated as a non-profit membership organization in 1951 "committed to the preservation of natural diversity by protecting lands containing the best examples of all components of our natural world." Through a combination of extensive private fund raising, the solicitation of land donations, and assistance on land transactions with state and federal agencies, the Conservancy has been responsible for protecting 1,395,329 acres within the United States since 1954. Ownership on about 60% of the lands acquired by The Nature Conservancy is retained and managed by volunteer land stewards. Other acquired lands are sold or donated to federal and state agencies to manage as preserved lands (The Nature Conservancy, 1979). The efforts of

The Nature Conservancy in preserving natural areas have been primarily directed towards saving lands that contain either threatened habitat for endangered plant and animal species or undisturbed examples of terrestrial and aquatic ecosystems.

The Nature Conservancy's efforts at preserving natural heritage prior to the 1970's were identical to state and federal agency efforts that have been outlined above. The focus was on preservation of specific sites that appeared to contain outstanding aggregates of natural heritage components: plant and animal species (especially uncommon species), their habitats, ecosystems, and other phenomena contributing to natural diversity. For example, the Forest Service was concerned with preserving examples of every major native forest type (SAF types). The Federal Committee on Ecological Reserves established an expanded classification system that considered Küchler potential natural vegetation types, zoological taxonomic types, geologic types, aquatic types, and Soil Conservation Service pedologic types, in addition to the SAF forest types. The Committee then attempted to locate sites that contained aggregates of types not protected elsewhere. All these efforts constitute a site-based approach to preserving natural diversity. The rationale is that if an adequate number of selected sites are preserved on the basis of sound classification schemes, the various components that contribute to natural diversity will be protected.

Federal legislation influenced the development of natural heritage inventories: the Land and Water Conservation Fund Act of 1965, the National Environmental Policy Act of 1969, and the Endangered Species Act of 1973. These acts created a statutory framework that natural heritage inventories could supplement.

The Land and Water Conservation Fund Act of 1965 (16 U.S.C. 401-4 et seq.) was enacted to:

> . . . assist in preserving, developing, and assuring accessibility to all citizens of the United States of America of present and future generations . . . such quality and quantity of outdoor recreation resources . . . for individual active participation in such recreation and to strengthen the health and vitality of the citizens . . . by (1) providing funds for an authorizing Federal assistance to the States in planning, acquisition, and development of needed land and water areas and facilities and (2) providing funds for Federal acquisition and development of certain lands and other areas (Section 4601-4).

The fund was established as a separate fund in the Treasury comprising entrance and user fees (to any area administered by federal government with recreation facilities), surplus property sales, motorboat fuels tax, outer continental shelf mineral leasing receipts, and direct appropriations. Amendments to the Act in 1968 and 1976 responded to escalating land costs and have increased the fund to where $900 million may be appropriated for fiscal year 1980. States have used their share of the fund (allocated 60% state and 40% federal) for acquisition of natural areas principally valuable for outdoor recreation and wildlife preservation, besides a myriad of recreational concerns (Howard, 1977).

The National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 et seq.) set forth a policy "recognizing the profound impact of man's activity on the interrelationships of all components of the natural environment" and established that the future role of the federal government will be to:

> use all practicable means and measures, including financial and technical assistance . . . to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (Section 4331).

Broad national goals in the management of the environment were set including:

> to preserve important historic, cultural, and natural aspects of our national heritage, and to maintain wherever possible an environment which supports diversity and variety of individual choice (Section 4332).

Section 4332(C) of the Act contained the "action forcing" provisions of NEPA. Each federal agency which proposed legislation and/or any other major federal action having a significant effect on the quality of the human environment was required to prepare an Environmental Impact Statement. This statement must detail unavoidable environmental effects, alternatives to the proposed action, long-term productivity effects, and any irreversible commitments of resources which would occur if the proposed action was implemented. Guidelines established by the Council of Environmental Quality stipulate that environmental impact statements must address potential impact on endangered and threatened plant and animal species.

The Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.) was a significant revision of two previous endangered species acts passed in the 1960's. The 1973 Act changed the definition of species to include plants as well as fish and wildlife. The purpose of the Act is:

> to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, (and) to provide a program for the conservation of such endangered and threatened species . . . (Section 1531).

Endangered species are defined in Section 1532 as:

> any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary to consititute a pest whose protection under the provisions of the Act would present an overwhelming and overriding risk to man.

Similarly, threatened species are defined as:

> any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

To accomplish the goals of the Act, Section 1537 stated that federal departments and agencies should take action necessary:

> to insure that actions authorized, funded, or carried out by them do not jeopardize the continued existence of such endangered species and threatened species or result in the destruction or modification of habitat of such species which is determined . . . to be critical.

The Secretary of the Interior is instructed by the Act to continually review the status of plants and animals for potential listing as an endangered or threatened species. Nominations submitted from the public are to be reviewed by the Secretary as well. A list of all endangered and threatened animal species should be published periodically in the Federal Register by the Secretary under the guidelines of the Act. Responsibility for studying potentially endangered and threatened plant species was delegated to the Secretary of the Smithsonian Institution. Such a report was published by the Smithsonian Institution in 1974. The Act further instructed that land and waters could be acquired by the Secretary of Interior for the protection of endangered and threatened species. The designated funding source was the Land and Water Conservation Fund, although funding levels to the Fish and Wildlife Service (responsible for administering the endangered species program within the Department of Interior) were not increased.

The Endangered Species Act Amendments of 1978 (P.L. 95-632) altered the restrictions imposed by Section 1537 by establishing a seven member Cabinet-level committee to review federal projects jeopardizing

endangered species for possible exemption from the Act's provisions. A project may be exempted if the committee finds the project is in the public interest and that no other "reasonable or prudent alternatives" exist. In addition, the definition of species in the 1973 Act was modified to exclude invertebrate species. Under the 1978 Amendments, economic analysis must precede future designation of critical habitat for endangered and threatened species (Bureau of National Affairs, 1978).

Two trends should be evident in the discussions above. As the United States moved into the 1970's, efforts to protect natural diversity by natural area preservation were expanding and becoming more sophisticated. Secondly, the federal government began to recognize the value of protecting all components of natural diversity, and a statutory framework was created through the National Environmental Policy Act and the Endangered Species Act for their preservation.

The first natural heritage inventory was established in South Carolina by The Nature Conservancy in 1974. It represented a significant departure from existing natural area inventories because it comprehensively identified and mapped individual elements of natural diversity. This systematic approach refined natural area selection procedures by providing a data base to verify and rank areas based on the presence of natural diversity components. The heritage inventory addressed the concerns of NEPA and the Endangered Species Act by initiating a system that provided decision makers with a single information source from which the location of uncommon species, biotic communities, and ecosystems could be obtained.

The methodology used by The Nature Conservancy in South Carolina, and other states subsequently, is examined in detail below (Chapter 3). Briefly, a natural heritage inventory is initiated by establishing a classification scheme and creating natural diversity component or element definitions. An element may be an endangered or threatened species, forest type, paleontological site, aquatic community, etc. A comprehensive state review of all research and literature pertaining to the location of these elements is conducted. Then the element occurrences are mapped and the information stored within a data bank. The information bank is continuously updated as additional research and field studies are conducted.

Natural area programs and natural heritage inventories are different means to the same end: preservation of natural diversity. A site-based inventory such as a natural area system provides information on natural diversity limited to those sites that have previously been judged important. Through its comprehensive scope, the natural heritage inventory has the capability to describe the presence or lack of natural diversity on any site, regardless of prior attention, hence its utility as a tool for implementation of NEPA and the Endangered Species Act.

Natural area programs that have been individually designed by Georgia, Wisconsin, and Illinois represent a cross between conventional site-based and element-based inventories. These programs use prepared lists of endangered species, plant communities, and ecosystems to select natural areas for inventory recognition. The natural area inventories in these states are therefore of a comprehensive nature. However, data retrieval is limited to those areas that have been recognized by the surveys. These programs are discussed in Chapter 3.

Natural heritage inventory development was undertaken by The Nature Conservancy for several reasons. Escalating land costs in the 1960's and 1970's dictated to a conservation organization concerned with acquiring and preserving significant lands that limited funds available for acquisition be spent systematically. As stated previously, a comprehensive state-wide inventory allows candidate sites to be given a priority ranking based on the composition and extent of natural diversity present. Available funds can then be used to protect areas containing the fullest spectrum of ecological diversity. Recognizing significant areas after critical heritage elements have been located on them lessens the probability that areas deserving protection will be overlooked. Inventory applicability to NEPA and the Endangered Species Act was undoubtedly another consideration of The Nature Conservancy in the initiation of development of natural heritage inventories.

Natural heritage inventories designed by The Nature Conservancy have been established in 18 states and the Tennessee Valley Authority since the South Carolina program was initiated in 1974 (Feiner, personal communication, 1978). Many of the inventories are incorporated into state natural heritage programs which select and propose lands for protection in addition to identifying elements of natural diversity. The Nature Conservancy has coordinated inventory development under contractual arrangements with each state before assisting and encouraging the incorporation of the operating inventory into the respective state government. Funding for the programs has been obtained from a variety of sources including state allocations of the Land and Water Conservation Fund, state appropriations, agency budgets, and Nature Conservancy donations.

Existing state Nature Conservancy programs generally have been regarded as successful and have subsequently received national recognition. Action has been taken by President Carter to promote a national system of heritage inventories. President Carter, in his Environmental Message of May 23, 1977, to Congress, called for a national heritage program preserving places of special, natural, historic, and scientific value. To coordinate existing federal activities in outdoor recreation and the protection of historic and natural areas, the Heritage Conservation and Recreation Service was established within the Department of Interior by Secretarial order on January 25, 1978. The Heritage Conservation and Recreation Service (HCRS) consists of a reconstitution of the Bureau of Outdoor Recreation with its authorities, including the Land and Water Conservation Fund program, and the addition of the National Natural Landmarks program administered by the National Park Service and the Park Service's Office of Archaeology and Historic Preservation (Feiner, personal communication, 1978).

The Natural Diversity Act bill (S. 1820) was introduced into the 95th Congress to establish a national heritage program by earmarking Land and Water Conservation funds for development of state heritage programs. The Nature Conservancy inventory methodology was incorporated into the bill for state program modeling. The bill failed to pass Congress, primarily because it required states to develop heritage programs in order to qualify for continuing land acquisition monies from the Land and Water Conservation Fund. Furthermore, the bill would have created a national registry of heritage sites. According to the bill's provisions, these sites would have been protected from any federal action that would

adversely impact or destroy elements of natural diversity. Special interest groups, including the timber industry and U.S. Chamber of Commerce, mounted strong opposition to the regulatory provisions of the bill, claiming the legislation would duplicate existing preservation efforts. The HCRS is currently drafting new legislation for introduction into the 96th Congress in which state participation would be optional (Merikangas, personal communication, 1978).

In summary, human activity in land development and natural resource utilization has resulted in significant impact on natural diversity. Natural diversity is valued as a genetic resource, as a subject for scientific study, as an interpretive resource for education, and for aesthetic qualities it lends our environment. The value of preserving natural diversity has been recognized, and various actions have been taken to provide for its conservation. Comprehensive state natural heritage inventories have been instituted in several states as a means of identifying remaining natural diversity and facilitating compliance with federal statutes that require attention be given to threatened elements of our natural diversity. A review of these state inventories will elucidate their purpose, structure, and impact.

Chapter 3

SELECTED REVIEW OF STATE NATURAL HERITAGE INVENTORIES

There are more than twenty existing state natural heritage inventory programs in the United States. In considering potential inventory development, Montana State government has chosen to evaluate other states' experiences with comprehensive inventories. The objective of this section is to provide in-depth review of a selected group of state inventory programs. Three criteria were considered in determining which states to review. State inventories were selected if: 1) the state's physiography was comparable to Montana (preference was given to adjacent states in the Northwest and Rocky Mountains as future interchange of inventory information is most likely to occur among neighboring states); 2) the inventory program was nationally recognized as an exemplary Nature Conservancy program; or 3) state government had independently designed an inventory program. These considerations resulted in ten states being chosen for review: Oregon, Washington, Colorado, Wyoming, New Mexico, Mississippi, North Carolina, Georgia, Illinois, and Wisconsin.

Information was gathered on the different program's objectives, relation to state government, history and funding, staff, inventory methodology, and utility. The compiled information is arranged under subheadings for each respective state below. The first seven state programs reviewed were developed by The Nature Conservancy and therefore utilize a relatively uniform inventory methodology. This methodology is

examined in detail within the Oregon Natural Heritage Program review and referred to thereafter.

Oregon Natural Heritage Program

Program objective. The Oregon Natural Heritage Program seeks to identify and evaluate lands which contain scientifically and ecologically valuable species or natural features. Specifically, the Oregon inventory catalogues occurrences of special plants, special animals, plant communities, geologic features, and aquatic communities. This information is used as a basis for establishing natural area preserves, guiding development in environmentally suitable directions, and assisting other land protection activities (Oregon Natural Heritage Program, 1978).

Relation to state government. The program has relied on state contracts for funding, and a bill is presently before the Oregon Legislature to incorporate the heritage program into a state natural heritage office (see below). Currently the program constitutes a private organization.

History and funding. The Oregon Natural Heritage Program was started in 1973 by the Oregon Chapter of the Nature Conservancy. For two years, small grants from numerous sources and donations from The Nature Conservancy kept the program operational. In January, 1975, the heritage program contracted with the State Parks and Recreation Branch of the Department of Transportation to collect information and prepare a report on existing state natural areas and potential natural areas. The state contributed $20,000 to match $20,000 donated by The Nature Conservancy for completion of the project (Rifer, personal communication, 1978).

Between October, 1975, and December, 1977, the heritage program operated under major contracts with the state land use planning agency, the Land Conservation and Development Commission. These contracts totaled $97,000 from a mixture of federal funding sources including the Office of Coastal Zone Management and Department of Housing and Urban Development. Reports were published in accordance with statewide planning goals that indicated the location, quality, and quantity of ecologically and scientifically significant natural areas. From January, 1978, through April, 1979, the program was again contracted by the State Parks and Recreation Branch to computer-store all previously gained information on Oregon natural diversity for development of the Oregon Statewide Comprehensive Outdoor Recreation Plan (SCORP) (Rifer, personal communication, 1978).

Presently the Oregon program operates under no regular funding. A bill has been introduced into the Oregon legislature that would create a state natural heritage office in the Department of Transportation. Committee hearings on the bill have been supportive for passage of the legislation (Rifer, personal communication, 1979).

Staff. The program has averaged the employment of a six-person staff. CETA has supported 50% of staff expenses from the beginning of the program. The heritage program has also participated in local work-study and intern programs (Kihn, personal communication, 1979).

Inventory methodology. Methods used by the Oregon Natural Heritage Program in acquiring data, classifying elements, mapping element occurrences, and storing information represent the general pattern

followed by eighteen states with Nature Conservancy inventory programs. This methodology is reviewed here at length as it functions in the Oregon program. Noreen Brown (personal communication, 1979), data specialist for the heritage program, provided much of the information for this review.

Information on the description, current status, and location of elements of natural diversity in Oregon was gathered from a variety of sources. Initially, several hundred letters requesting data were sent to individuals, organizations, and state and federal agencies considered knowledgeable in the nature and extent of Oregon's flora, fauna, and unique features. Personal interviews were conducted throughout the state. Much of the information received from this inquiry pertained to specific sites containing exceptional ecological diversity. Consequently the information was catalogued in a Site File. Scientific literature including relevant dissertations and theses was reviewed. A systematic study was made of the state's major herbarium and museum records. Generalized national directories were consulted, such as the Smithsonian Institute's Report on Endangered and Threatened Plant Species of the United States (1975) and the Fish and Wildlife Service's Threatened Wildlife of the United States (1973).

From the accumulated data on natural heritage features, the program's staff developed classification lists for each of the four classes of elements to be inventoried in Oregon: special plants, special animals, aquatic communities, and plant communities. For example, plant species were placed on the state special plant classification list if they were listed by the Smithsonian Institute as nationally endangered

or threatened; listed by the Oregon Rare and Endangered Plant Species Task Force (a volunteer group comprising amateur and professional botanists) as rare, threatened, or endangered; or proposed for listing by either organization. The prepared classification lists of elements were submitted to the national office of The Nature Conservancy which assigned a unique seven-character classification code for each element, consistent with other existing state inventories. This code consists of a two-character class code, a two-character subclass code, and a three-character element code. Class codes used in Oregon are PC (Plant Communities), AQ (Aquatic Habitats), SA (Special Animals), SP (Special Plants), and OT (Other--for divergent elements, such as unique geological features, that do not fit into the previous classification schemes). The subclass code represents major taxonomic or descriptive divisions within the classes. Each distinct element, whether it is an animal species or forest type, is given a unique element code by the national office. Element files are kept for each element where raw data including articles, correspondence, and unpublished documents are stored.

Definitions were developed for element occurrences in each element class. Generally an element occurrence is a single extant habitat or example of an element type. Specific element occurrence definitions are developed by each state program under national guidelines. The sighting of a rare invertebrate species by a knowledgeable zoologist may constitute an element occurrence for that class, while certain species of birds must be observed in a recognized breeding area to constitute an element occurrence. Element occurrence definitions are not fixed, but evolve as staff zoologists and botanists assimulate data

on species distribution statewide and accordingly develop insight into the rarity and significance of particular species.

Once classification lists and element occurrence definitions were established, the Oregon Natural Heritage Program was ready to map and store assembled data. The first step in processing data involves the transcription of data from raw information sources such as site forms in the Site File, museum specimens, theses, and field surveys onto forms so they are ready for computer processing. Before information is transcribed, staff personnel judge whether the information is processable. Processable information must meet the element occurrence definition and be capable of being mapped. Unprocessable information is filed and cross referenced by element and county. Processable information on each element occurrence is transcribed onto a LCD element occurrence form. LCD is an acronym for Lowest Common Denominator; this is the name for The Nature Conservancy computer storage system and is used in this context to signify the smallest amount of meaningful correlative data recorded for significant elements and features.

The LCD form contains the name of the element and classification code, a general description of its status, the source of information that led to recognition, date of information, current ownership of the land, and general and specific locational data. All information sources that have contributed processable element occurrences are recorded from the LCD form onto a source card and organized for future reference in a Source File. The LCD form is the key to the inventory methodology and must be accurately completed to insure smooth retrieval of stored data. The form is arranged to facilitate eventual data transcription onto keypunch cards.

Before the detailed locational data can be supplied for completion of the LCD form, each element occurrence must be mapped. The Map File of the heritage program is quite extensive. All 7½ minute topographic quadrangle maps published by the USGS for Oregon are in the file. Areas not currently covered by 7½ minute maps are represented in the file by USGS 15 minute topographic maps or BLM 30 minute maps. The smaller scale maps are artificially divided into 7½ minute sections and each section treated as a separate map. The Map File is organized by the fact that every area of the state is covered by a 7½ minute quadrangle. Each map is given a unique seven-digit number based on its relation to degree lines of longitude and latitude. This number is called the map's quad code.

The locational information on the LCD form and the Site form, when available, is used to map the element occurrence directly on the appropriate quadrangle. Different symbols are used to signify the degree of confidence with which the exact location of the element occurrence is known. Certain occurrences are field checked and can be mapped to the nearest second of longitude and latitude. Other element occurrences by their nature or lack of locational data may range over a mile and are mapped with an appropriate symbol of locational confidence. While a centerpoint symbol is used for all element occurrence mapping, boundaries may be drawn directly on the map to delimit an element such as a plant community. The presence of boundaries on the quadrangle map is noted on the LCD form.

Each element has a Directory Record which sequentially lists every element occurrence recorded in the state and contains the quad

code for the map on which the occurrence is found. An occurrence number is given to each sequential element occurrence, i.e., 001, 002, 003 . . . Once an element occurrence is mapped, the Directory Record is updated. The Directory Record provides a manual reference of an element's abundance within the state.

The actual quadrangle on which the element occurrence is mapped is updated by recording on its margins the element occurrence's longitude and latitude and index code. The index code consists of the element's classification code combined with its three-digit occurrence number.

The LCD form is now updated and prepared for processing. The index code, quad code, longitude and latitude, and township, range, and section are recorded on the LCD form. Site forms are updated and placed in the Geographical Manual File, also known as the Quad File. This file is arranged such that every 7½ minute quadrangle has a separate file; Site forms are placed in the file that represents the quadrangle on which respective element occurrences were mapped.

The common or geographical name for each site is recorded in a reference file known as the Gazetter. Without the Gazetter cross-reference, the ability to manually retrieve information on a particular site, without knowing the respective quad code, would be lost.

The information on the LCD form is keypunched, punched cards are submitted for computer processing, and data is stored on a tape file. After information has been successfully stored, the LCD form is placed in the respective Geographical Manual File. The standard printout of the stored data is arranged by element class so staff personnel can determine at anytime exactly what elements have been processed under the

inventory. As more information is obtained through field surveys and new research, data is continuously updated and added to the computer files for permanent storage.

The Oregon program was oriented initially through its contract with the Land Conservation and Development Commission to provide information on sites of natural diversity. Four years of data gathering resulted in the recognition of 1,200 separate sites. From these sites, approximately 4,000 element occurrences have been discerned. Computer processing of these occurrences began in June, 1978. As of March, 1979, 1,800 element occurrences had been stored.

Once the backlog of element occurrences are processed, information retrieval from the Oregon inventory may be directed in a variety of ways. Given the general location of an area under review, the simplest method of determining existing natural diversity is to check mapped element occurrences on the topographic quadrangle in the Map File. Using the Directory Record, each element mapped can be reviewed for its relative statewide abundance. A slightly more sophisticated manner of data retrieval is to request by quad code all element occurrences stored on the computer tape file. This information can also be obtained in reference to county, township, range, and section or longitude and latitude. The system has the capability to generate spatial information on the distribution of element types. For example, maps may be generated showing the distribution of Lodgepole pine/bitterbrush communities or a particular endangered species.

Utility. County land use planning departments have been the major users of Oregon inventory information. State agencies account for

another significant share of information requests. State requests have been made for information exchange on elements and sites, which is utilized to make preservation decisions.

During 1975-76 the Oregon Natural Heritage Program recorded and summarized information applications. Over 40 applications were received by local planning departments, 21 applications by state agencies, 18 requests by federal agencies, and there were 22 private requests for information. Much of the information requested pertained to locations of potential natural areas. Data was supplied to the Soil Conservation Service, Bureau of Land Management, and the Army Corps of Engineers for the drafting of Environmental Impact Statements (Oregon Natural Heritage Program, 1976).

The heritage program has been favorably evaluated for its utility in determining lands to be purchased by a $5 million bond issue passed by Eugene-Springfield residents for park and conservation area acquisition (Gordon, personal communication, 1979). The natural heritage inventory lended credibility to potentially controversial local planning decisions concerning what private lands to purchase. Similarly, a county planner for Lane County, Phil Bredeson (personal communication, 1979), cites several examples where inventory data has positively influenced local planning decisions involving conflicts of development and preservation of rare elements of natural diversity. The Lane County Planning Office has developed the attitude that if the heritage program is concerned about preserving a certain site, they are concerned. The Nature Conservancy is viewed as a pragmatic group with a sensitivity to local concerns often lacking among other national environmental organizations (Bredeson, personal communication, 1979).

Discussion. The Oregon Natural Heritage Program has maintained viable operations for five years through numerous state contracts. Presently its future maintenance depends on positive action by the state legislature to incorporate the program into state government. Agencies and individuals familiar with the program's functions are supportive. Incorporation of the program into state government would undoubtedly magnify present levels of use and generally enhance preservation activities.

Washington Natural Heritage Program

Program objective. The Washington program attempts to identify ecologically significant lands and other natural features whose preservation is important to safeguard the state's natural diversity. Special plants, special animals, plant communities, and aquatic communities constitute the features that are presently inventoried under the program (Washington Natural Heritage Program, 1977).

Relation to state government. The program is currently administered by The Nature Conservancy but may become part of Washington State government in 1980. The program is housed in the Department of Natural Resources through donated in-kind services (see below).

History and funding. The Washington program was initiated in December, 1977, by a cooperative agreement between The Nature Conservancy and the following state agencies:

- The Interagency Committee: Administers state Land and Water Conservation Fund monies and conducts State Comprehensive Outdoor Recreation Planning.

- The Department of Natural Resources: Responsible for the State Natural Area Preserves system and the Endangered Plant Species program.
- The Department of Game: Inventories locations of special wildlife species and habitats.
- The Parks and Recreation Commission: Establishes Natural Areas and Heritage Areas in Parks.
- The Department of Ecology: Conducts environmental impact assessment and administers the coastal zone program (Washington Natural Heritage Program, 1977).

A two-year developmental program was established by the agreement. Funding for the period totaled $252,000 which consisted of $126,000 in Nature Conservancy donations; $30,000 from in-kind services donated by the Departments of Natural Resources, Game, and Ecology, and the Parks and Recreation Commission; and $96,000 from the federal Land and Water Conservation Fund. The program currently has supplemental contracts with the United States Forest Service and Fish and Wildlife Service. When the two-year developmental period funding is exhausted in December, 1979, preliminary discussions have indicated that the heritage program will be jointly supported by the Departments of Natural Resources and Game. Annual maintenance costs are estimated to be $90,000 (Kihn, personal communication, 1979).

Staff. Full time staff consists of five to six individuals. During the 1978 field season, four part-time positions were funded.

Inventory methodology. The Washington program utilizes standard Nature Conservancy methodology (see Oregon review above), with minor alterations to meet specific state needs. The program has not developed an element class listing geological features. Biological features are

considered most sensitive to immediate threats of development and have been the focus of the Washington inventory (Matia, personal communication, 1979). Special plant and animal species listed by the Washington classification system are those which are rare, threatened, endangered, endemic, or otherwise of special concern. Twelve months since the inventory methodology was established, 3,000 element occurrences had been mapped and 1,265 LCD forms computer-recorded (Olsen, personal communication, 1979).

Utility. The Washington Natural Heritage Program is only 15 months old and has consequently not had a high degree of use. The program has been utilized in several important consultations including a review of proposed Northern Tier Pipeline corridors by the Bureau of Land Management and Research Natural Area studies by the United States Forest Service.

For the review of the Northern Tier Pipeline corridors, the program was able to compile a 15-page summary of the special plant and animal species, plant communities, and scientific areas of interest located within a mile to either side of several proposed pipeline routes.

The Washington heritage program has been working closely with the Wenatchee National Forest on rare plant locations. The Forest Service has contributed funds to the heritage program, and a pamphlet is being prepared which lists and describes rare plant species thought to occur within the National Forest boundaries. This pamphlet will be used by Forest Service personnel in identifying locations of rare plants to avoid irreversible impact through management decisions like timber sales (Gjerston, personal communication, 1979).

Discussion. The Washington heritage program was developed in a state in which a wealth of information on the status of natural heritage features existed prior to inventory initiation. Plant community classification schemes had been developed previously by Daubenmire and Franklin. Work on rare and endangered species had been completed within the university system and Departments of Natural Resources and Game. Assimilation of secondary source data into computer files will take years to complete. Budgetary allocations for inventory development in a state such as Montana, where considerably less is known about existing natural heritage features, would have to provide for increased field operations (Matia, personal communication, 1979).

There have been some problems in Washington with information exchange between the cooperating state agencies. The heritage program is housed within the Department of Natural Resources and therefore viewed as a part of that agency. Staff members of the heritage program have had good rapport with Natural Resource officials but have experienced difficulty in freely obtaining zoological data from the Department of Game (Olsen, personal communication, 1979). Future financial sponsorship of the heritage program by both departments may alleviate this problem.

The Washington program staff learned in gathering information and establishing its classification system the value of obtaining early support from professionals with expertise in taxonomy and classification. These individuals have been approached on numerous occasions with requests to assist in inventory projects. If previously published work by the professionals is carefully reviewed prior to requesting assistance,

potential for a good working relationship is enhanced (Matia, personal communication, 1979).

Although the heritage program has not been in existence long, the regions of Washington that have been most neglected by preservation efforts have become obvious. Program Director Walt Matia realizes that grassland communities in the Columbian Basin steppe region need special attention.

Matia feels the heritage program is providing a valuable service to Washington State by: 1) furnishing an inventory with a narrow focus that objectively evaluates rarity/uniqueness of natural heritage elements and discerns which lands contribute to natural diversity without subjective considerations of scenic value, proximity to urban areas, and political impact entering the program's deliberations; 2) eliminating the high costs of consulting firms; and 3) allowing frequent state and federal questions on endangered and threatened species, that arise from legal considerations, to be answered by an "in-house" phone call.

Colorado Natural Areas Program

Program objective. Under mandate by the Colorado Natural Areas Act, the goal of the program is to identify and protect a sufficient array of natural areas to represent the different vegetation types and unique natural features comprising Colorado's natural diversity. The program is directed by the Natural Areas Act to establish a systematic inventory of natural areas to identify and protect specific examples of Colorado's diverse ecosystems, ecological communities, and other natural features or phenomena which constitute Colorado's natural heritage and

are threatened with irreversible change (Section 36-10-101 et seq. Colorado Revised Statutes Annotated 1973). This objective is being met by the codevelopment of an inventory of natural diversity elements by The Nature Conservancy and Colorado Natural Areas Program.

Relation to state government. The Colorado Natural Areas Program is administered by the Department of Natural Resources.

History and funding. The Natural Areas Program started in August, 1977, after the Natural Areas Act was enacted. Initial annual funding consisted of $18,537 from state appropriations and $18,487 from federal Land and Water Conservation funds. In February, 1979, the Colorado Department of Natural Resources contracted with The Nature Conservancy to develop an inventory system under guidelines established by the Natural Areas Program. The budget for the 18-month contract period, ending in July, 1980, totals $277,459. Funding consists of $30,709 in state appropriations, $97,625 of Nature Conservancy donations, $125,125 from the Land and Water Conservation Fund, $15,000 in Forest Service funds, and $9,000 from Bureau of Land Management funds (Pustmueller, personal communication, 1979).

Staff. The Natural Areas Program employed two full-time staff prior to inventory initiation in February, 1979. Present staff includes six individuals: program director, inventory coordinator/zoologist, secretary, data handler, geologist, and botanist. Once the inventory contract expires, the program hopes to get state funding for 2.5 permanent positions (Pustmueller, personal communication, 1979).

Inventory methodology. The system that is currently being established in Colorado follows Nature Conservancy format, with some significant modifications. The Nature Conservancy has been directed to not build the inventory program around LCD computer software but to make the inventory data system compatible with the existing EXIR system at the University of Colorado. The Colorado Heritage Center already has a sound archaeological inventory on the university computer system, and the State Historical Society is considering entering data onto the same system. The Natural Areas Program does not want to introduce a new computer software program into Colorado and feels that the EXIR system will allow more descripters to be put into file than the LCD system (Pustmueller, personal communication, 1979).

A second modification to the standard Nature Conservancy format is the use of a Draft Classification System developed by Natural Areas Program staff and interested Colorado scientists and individuals. The Nature Conservancy has been instructed to build the inventory system around this classification scheme which identifies the elements upon which data will be collected. Major categories (element classes) in the system are plant communities, aquatic systems, geologic features and landforms, soils, special plant and animal species, and special habitats (rookeries, migratory routes, sand dunes, examples of symbiotic associations, etc.). Since 45% of Colorado lands are federally-owned, inventory success depends on the cooperation of federal agencies. The classification system has consequently been developed to accommodate the regional classification systems currently used by the BLM (physiographic regions), USFS (ecoregions), and Soil Conservation Service (land resource regions) (Colorado Natural Areas Program, 1978).

Utility. The Colorado inventory is not operational at this point. The program's director, Carse Pustmueller (personal communication, 1979), foresees numerous uses of inventory information:

- Selection of Natural Areas by the state.
- Selection of Research Natural Areas by federal land-managing agencies.
- Environmental Impact Statement preparation.
- State review of federally-aided highway projects under the provisions of the Office of Management and Budget's circular A-95.
- Park and Recreation Master Planning.
- Designation of lands unsuitable for surface coal mining by the Division of Mined Land Reclamation.
- Education and scientific research.

Discussion. Colorado contracted inventory development with The Nature Conservancy for several reasons. The Natural Areas Program conducted a survey of states with Conservancy heritage programs and received very favorable reports on the performance of the respective programs. The large donation contributed by The Nature Conservancy towards inventory development made the contract financially lucrative for the Department of Natural Resources. Furthermore, Conservancy involvement insured that inventory methodology would be compatible with other state heritage programs (Pustmueller, personal communication, 1979).

The Colorado program has developed a good cooperative arrangement with the United States Forest Service and the Bureau of Land Management. This cooperation was generated by the program soliciting the federal agencies' input early in the planning process. Federal funds have been contributed, and implementation of the inventory on federal

lands will undoubtedly be facilitated by good relations between the program and federal land managing agencies.

Wyoming Natural Heritage Program

Program objective. Wyoming's program was only recently started. In the first year, the main objective will be to provide support for the state's process of designating areas unsuitable for surface mining (Minier, personal communication, 1979). The state's need to establish a program for designating lands unsuitable for mining has resulted from the requirements of the federal Surface Mining Control and Reclamation Act of 1977, discussed in Chapter 4.

Relation to state government. The Wyoming Natural Heritage Program is being established by The Nature Conservancy as an independent contractor to the Department of Environmental Quality.

History and funding. The contract between The Nature Conservancy and Department of Environmental Quality for inventory development was signed November 1, 1978, and is in effect for one year. The budget for the year is $128,340 which is being funded with a portion of the funds available to the state for state program development under the federal Surface Mining Control and Reclamation Act (SMCRA). The first year of state program development under SMCRA provides for costs to be shared on a federal-state basis of 80%-20%. Funding is assured only for the first year, but a budget of $96,398 has been developed for second-year operations (Minier, personal communication, 1979).

Staff. The Wyoming staff consists of a program coordinator, scientist, data specialist, and secretary/data manager. In addition, the Department of Environmental Quality has assigned a state employee to serve as liaison with Conservancy personnel (Minier, personal communication, 1979).

Inventory methodology. Wyoming methodology will follow traditional Nature Conservancy patterns (see review of Oregon program above). Features addressed in the inventory will be the standard scientific resources inventoried in other natural heritage programs (Nutter, personal communication, 1979).

Utility. Once the program is operational, the same potential will exist for data utilization as is present with other Conservancy heritage programs. Al Minier (1979), a natural resource advisor in Wyoming's Executive Department, anticipates that in the inventory's first year the major users will be petitioners who wish to designate areas unsuitable for surface mining.

Discussion. The federal Surface Mining Control and Reclamation Act is discussed in detail in Chapter 4. Briefly, the Act requires that states with coal regulatory programs develop a data base and inventory system capable of discerning those lands with scientific, historic, and cultural value and the geological areas where coal mining would be hazardous. Federal funds are provided for development of inventory systems. While the Wyoming Natural Heritage Program will only identify scientific resources, state officials have secured federal funds through the Surface Mining Act to finance the program. Approximately 50%

of Wyoming land has coal mining potential; the heritage program will comprehensively cover the entire state. Inventory data on lands with historical and cultural value is currently housed in separate state agencies. The Wyoming Geological Survey has data available to develop an inventory of natural hazard lands. No effort will be made to combine the various inventories into a central system (Minier, personal communication, 1979).

Like Wyoming, the state of Montana is subject to the provisions of SMCRA. Within the Montana Department of State Lands, Strip Mining Bureau Chief Dick Juntunen (personal communication, 1979) views the actions of Wyoming with some skepticism. Juntunen feels that federal funding of a state inventory system, not limited to lands with coal potential and addressing a fraction of the resources identified by SMCRA, is a waste of taxpayer's money. Al Minier (personal communication, 1979) rejoins that if the federal Office of Surface Mining does not like what Wyoming is doing they can take the state to court. The Wyoming contract with The Nature Conservancy contains a clause that stipulates the state has the right to terminate the agreement if, for any reasons, the federal government terminates its program development grant to the state.

New Mexico State Heritage Program

Program objective. The New Mexico program has two major objectives. One is the location, description, and designation of natural areas. Secondly, the program works on the overall inventory and synthesis of biotic and geologic data in the state. This data is organized and systematized such that it can be utilized by federal, state, and local

government entities and by private concerns. Specifically, the inventory catalogues rare and endangered plants and animals, common species of plants and animals, geological features (waterfalls, caves, springs, cirques, etc.), plant communities, and aquatic communities. Soil types, paleontological sites, and hydrological data will potentially be included in the inventory system (Isaacs, personal communication, 1979).

Relation to state government. The heritage program is part of the Administrative Services Division of the Natural Resources Department.

History and funding. The New Mexico program was initiated on January 1, 1976. For the program's first year operations, The Nature Conservancy donated $50,000 to match $50,000 in federal funds from the Land and Water Conservation Fund. Since 1977 the program's operations have been based on a year-to-year contract between the Natural Resource Department and the Heritage Conservation and Recreation Service. The 1977 to 1978 budget was $80,000, and the projected 1978 to 1979 budget is $100,000. Both budgets have consisted of matching state general funds and federal Land and Water Conservation funds (Isaacs, personal communication, 1979).

Staff. Four positions comprise the New Mexico permanent staff: program coordinator, environmental analyst, management analyst, and keypuncher/secretary. Four to five people from New Mexico State University have been on contract doing unique ecosystems work for the Fish and Wildlife Service. CETA currently provides three additional staff positions (Kihn, personal communication, 1979).

Inventory methodology. Nature Conservancy methodology is followed in New Mexico. Classification systems are being developed for including paleontological sites and common plant and nongame animal species in the inventory. Paleontological classification may be accomplished by grouping fossil specimens by major taxonomic divisions. Plant herbarium records are being searched to obtain township, range, and section locations of vascular plant species (excluding endangered and threatened species which have been inventoried previously). Expanding the inventory in this manner will be a monumental task, as an estimated 100,000 separate plant locations will eventually be recorded (Isaacs, personal communication, 1979).

Utility. The heritage program has received requests for information from more than one hundred organizations and individuals since its inception. There have been multiple requests from virtually all federal land management agencies. The Bureau of Land Management alone averages two requests per month.

The program routinely reviews Environmental Impact Statements, environmental assessments, and environmental reports of New Mexico for data on endangered species, natural areas, biotic communities, and geologic features. Additionally, the program conducts the state A-95 reviews of federally-aided highway projects (Isaacs, personal communication, 1979).

The New Mexico State Highway Department channels all proposed projects through the heritage office for review. Sterling Mathias (personal communication, 1979) of the Highway Department reports that reliable and well-substantiated information about the occurrences of

threatened or endangered plants and animals is received from the heritage program, and the turnaround for an emergency-type project has been a few hours. Written requests for large groups of projects have typically received comprehensive written replies in a few weeks.

The New Mexico program has developed a harmonious working relationship with the major privately-owned public utility in the state, the Public Service Company of New Mexico. The utilities' Environmental Affairs Department employs thirty-one environmental scientists and conducts comprehensive studies within New Mexico. In exchange for assistance received from the heritage program, the company forwards all its pertinent information to the program (Sabo, personal communication, 1979).

Discussion. The New Mexico inventory has one of the broadest scopes of existing heritage inventories in the country. A wealth of data has been accumulated by the program. With complementary efforts by strong historical and archaeological preservation groups, New Mexico's heritage features are becoming well-documented.

The New Mexico heritage program experienced problems initially assimilating data at a rate they felt acceptable. This was basically a result of insufficient manpower. Recently, three additional CETA positions have been added to the program's staff. The mapping phase of inventory methodology takes the most time, especially when locational data on elements is incomplete (Isaacs, personal communication, 1979).

For a state considering the development of a state natural heritage program, New Mexico program coordinator Bill Isaacs (personal communication, 1979) offered the following suggestions:

- Be sure concerned parties agree on general goals and philosophy.
- Get the top biologists and geologists in on the early stages of development so that they feel they have a stake in the program and its products. Such people have much to give and can also benefit from the heritage system.
- Try to involve federal agencies in the program as much as possible. They are often its greatest users.
- The program head or coordinator should have some experience in biology, preferably in ecology or taxonomy, be able to work with the public, and have some sensitivity to political and economic realities. The program will serve no purpose if it is lost due to excess environmental activism or lack of budgetary restraint.
- Do not slip into the mistake of becoming so research-oriented that the universities see the program as possible competition. The state's goal is to supply useful information that is accurate--not to do original research.
- Be sure high level administrators are aware and approve of the program. Good work can come to nothing if the program is misunderstood.

Mississippi Natural Heritage Program

Program objective. The preservation of natural diversity by identifying outstanding natural areas through a statewide inventory and setting priorities for their protection is the objective of the Mississippi Natural Heritage Program. Classes of elements for which occurrences are being collected in the statewide inventory are special plants, special animals, plant communities, aquatic habitats, and special features (rookeries, champion trees, caves, fossil formations, etc.) (Jacob, personal communication, 1979).

Relation to state government. The heritage program is administered and supported by the Mississippi Museum of Natural Science (Jacob, personal communication, 1979).

History and funding. The pilot inventory was established in March, 1976. Four state agencies made funding available for the heritage program: the Mississippi Park Commission, the Wildlife Heritage Committee, the Pat Harrison Waterway District, and the Pearl River Basin Development District. These agencies contributed a total of $57,500 for the first year budget, and matching funds were obtained through the Land and Water Conservation Fund. The Nature Conservancy supported two staff positions through donations solicited in the state. Currently the program is being maintained by an annual budget of $97,709 of which $60,623 comes from the state and $37,086 from the Land and Water Conservation Fund (Jacob, personal communication, 1979).

Staff. The Mississippi program has five full-time staff; two are supported by The Nature Conservancy (Kihn, personal communication, 1979).

Inventory methodology. Mississippi utilizes classical Nature Conservancy methodology (see Oregon review above).

Utility. Over 2,000 element occurrences are stored in the Mississippi inventory system. In 1978, after two years of operations, the program's staff had supplied information on more than 200 separate occasions to 30 levels of 10 federal agencies, 25 levels of state agencies, 7 private consulting firms, 8 industries, universities, museums, and various other organizations (Davis and Jacob, 1977).

The heritage program does not act as an official agent in environmental review procedures, but heritage data is being increasingly used in A-95 reviews of federally-aided highway projects and environmental

impact analysis. Under Mississippi's Reclamation Act, the heritage program recommends those areas considered unsuitable for surface mining (Jacob, personal communication, 1979).

The inventory has prompted donations of valuable natural areas by the private sector. The field staff of the heritage program identified an outstanding geological formation of seven spectacular waterfalls set among an old growth forest of 430 acres. International Paper Company planned to cut the tibmer, but when informed by heritage staff of the geological value of the area, the company donated the land to the state of Mississippi (Sanders, 1978).

Discussion. After three years of coordinating the Mississippi heritage program, Joseph Jacob has become a staunch advocate of Nature Conservancy inventory methodology:

> It is very scientifically oriented and objective and takes the personal biases out of the important task of establishing a natural area system. In Mississippi, we have neither the time nor the money to protect all that needs protection; therefore we have to be sure that we identify the most important natural areas and see to it that they are protected first (Knight, personal communication, 1979).

One problem the program has encountered in developing their inventory is the lack of field research providing information on the locations of elements of natural diversity in certain areas of the state. The inventory has indicated where these areas are; the heritage program staff is assisting the state's academic community in getting to the field to find the information useful to the program (Knight, personal communication, 1979).

Public response to the Mississippi heritage program has evidently been quite supportive:

> Mississippians can see what is happening to the natural environment of our State and they are thankful that somebody is doing something to preserve their natural heritage; it's a motherhood and apple pie issue (Jacob, personal communication, 1979).

North Carolina Natural Heritage Program

Program objective. The North Carolina Natural Heritage Program is designed to inventory the state's critical elements of natural diversity and to identify those natural areas most deserving protection. Establishment of a permanently protected system of nature preserves is a major goal, with emphasis on designation of natural areas on public lands. The heritage inventory catalogues special plants and animals, plant communities, physical features, aquatic features, and special wildlife habitats (North Carolina Department of Natural Resources and Community Development, 1978).

Relation to state government. The natural heritage program is part of the Parks and Recreation Division of the Department of Natural Resources and Community Development (Kihn, personal communication, 1979).

History and funding. The state of North Carolina, through its Department of Natural Resources, entered into a contract with The Nature Conservancy to develop an inventory on April 1, 1976. The initial phase of the heritage program lasted 16 months under a budget of $160,000; $80,000 was made available by two private North Carolina foundations (solicited by The Nature Conservancy) and $80,000 came from Land and Water Conservation funds. The present budget totals $115,000: $87,000 from the Coastal Regional Plains Regulatory Commission (U.S. Department of Commerce), $18,000 for staff from the Land and Water Conservation

Fund, $5,000 from the Wildlife Resources Commission, and $5,000 from the Coastal Resources Commission. The State General Assembly is currently considering a request by the Governor for a $75,000 annual appropriation to support heritage program personnel. Such appropriations would be matchable to receive additional federal monies (Roe, personal communication, 1979).

Staff. Full-time staff comprises four individuals: program coordinator, zoologist, botanist, and secretary/data processor. Several part-time research aids are employed. University personnel have been contracted when possible for survey work.

Inventory methodology. Nature Conservancy methodology is used in the North Carolina heritage inventory (see Oregon review above). A classification system was established prior to data gathering to describe and document the elements of natural diversity. In 1975 the Symposium on Endangered and Threatened Biota of North Carolina, sponsored by the State Museum of Natural History, developed classification categories that were adopted by the heritage program for use in classifying elements in the special plant and animal classes. A classification of potential vegetation associations by Dr. A. E. Radford of the University of North Carolina, Chapel Hill, was endorsed for use in the plant community class of the inventory. State geologists were consulted and lists prepared of examples of unique geologic, physiographic, and aquatic features. These features constitute the physical features class (North Carolina Department of Natural Resources and Community Development, 1978).

Over 5,000 element occurrence records have been processed by the North Carolina heritage inventory. Data from the inventory has been integrated with the COMARC computer mapping capabilities of North Carolina's Department of Land Resources Information Service. The COMARC facilities are not utilized by the heritage program to a great extent due to $40 per hour user fees. Some problems have been experienced mapping plant community types due to the imprecise nature of available data (Roe, personal communication, 1979).

Utility. The North Carolina Natural Heritage Program ranks among the most heavily used heritage programs in the country. Staff personnel respond to some 200 inventory data requests annually. Data is regularly utilized by eleven state agencies including the Department of Transportation, State Museum of Natural History, Coastal Resources Commission, and Division of Environmental Assessment. Federal agencies that used natural heritage information in 1978 were the Army Corps of Engineers, Fish and Wildlife Service, National Park Service, Soil Conservation Service, Forest Service, Department of Housing and Urban Development, Bureau of Land Management, Heritage Conservation and Recreation Service, and Tennessee Valley Authority. The Forest Service utilizes inventory data to assist their North Carolina forest inventories and unit planning. Priorities are established for protection and acquisition of wildlife habitats by the Fish and Wildlife Service with the aid of heritage program information. The National Park Service has used inventory data in developing management plans for the Great Smoky Mountains and Cape Hatteras National Parks and in the evaluation of potential National Natural Landmarks (Knight, personal communication, 1979).

Private sector information requests have come from Carolina Power and Light, Duke Power, timber companies, The Nature Conservancy, and 201 facility planning and engineering firms. The Nature Conservancy has acquired 30,000 acres in the state following consultation with the state heritage program (North Carolina Department of Natural Resources and Community Development, 1978).

Similar to other state heritage programs, the North Carolina program routinely reviews Environmental Impact Statements and A-95 reviews. Approximately ten environmental reviews of proposed actions are completed by the program each month (Kihn, personal communication, 1979).

The high degree of use the North Carolina heritage inventory has had is undoubtedly the result of its comprehensive coverage of the state's natural diversity (5,000 element occurrences logged) and efforts of the heritage program in generating public awareness and involvement. Work has been channeled into the preparation of media presentations and articles; participation in workshops, conferences, and organizational meetings; distribution of information; and other attention to public relations. A recent workshop on the nature and capabilities of the heritage program attracted 120 participants from the academic community, public agencies, and conservation organizations (North Carolina Department of Natural Resources and Community Development, 1978).

Discussion. The North Carolina Natural Heritage Program has established itself as an exemplary Nature Conservancy program. Comprehensive inventory data has been successfully assimulated into a computer system that permits efficient retrieval to fulfill specialized information

requests. Following a development period supported in part by The Nature Conservancy, the heritage program is now widely endorsed by state government and consequently funded through state appropriations and federal grants. A high degree of inventory use serves to justify the program's continued maintenance. With solid information in the heritage data bank, the program has increased emphasis on the implementation of protection strategies (Kihn, personal communication, 1979).

Charles Roe (personal communication, 1979), the coordinator of the North Carolina Natural Heritage program, feels that the program has the capability to be expanded to include cultural heritage features. Roe reports that the Tennessee Natural Heritage Program has successfully developed classification systems for historical and archaeological features that allow incorporation into Nature Conservancy data storage methodology. Rex Boner (personal communication, 1979) of the Tennessee program states that such classification was developed over the last two years and is based on such criteria as time period and architectural style for historical features, and time frame and watershed for archaeological features. The Tennessee Heritage Program is collecting the information for transcription into their data system from the State Historical Society and Office of Archaeology.

Georgia Heritage Trust

Program objective. The Georgia Heritage Trust operates under the goals stated in the Heritage Trust Act of 1975, which are to insure that a sufficiency of recreational resources be provided for the people of the state and that important and endangered elements of Georgia's

natural and cultural heritage be identified and protected. Endangered heritage features have been identified through a site-oriented statewide inventory (Georgia Department of Natural Resources, 1978).

Relation to state government. The Georgia Heritage Trust operates primarily through the Planning and Research Division of the Department of Natural Resources, although advisory personnel contribute to the Trust's activities from all divisions of the Department.

History and funding. The Heritage Trust was established by executive order of Governor Jimmy Carter in July, 1972. The program was reconfirmed in law with the passage of the Heritage Trust Act of 1975. Carter's executive order created a Georgia Heritage Trust Advisory Commission comprising 15 prominent Georgians representing various public and private conservation interests. The Advisory Commission's primary goals were: 1) to establish procedures for identifying, acquiring, and protecting the vital elements of Georgia's heritage; 2) to create a program for the immediate acquisition of the most significant and endangered historical, environmental, and recreational areas; and 3) to establish a method for periodic review and determination of additional areas to assure the continuing quality of life in Georgia (Georgia Department of Natural Resources, 1974).

Two committees were formed by the Commission to initiate the Heritage Trust Program. An eight-member Implementation Task Force conducted an analysis of the legal and financial problems, and opportunities of executing the Georgia Heritage Trust concept. The Commission also created an inter-agency and inter-disciplinary Technical Task Force

composed of professional staff members of the Georgia Forestry Commission, Georgia Historical Commission, Office of Planning and Budget, Department of Archives, and the Department of Natural Resources.

The Task Force developed a priority listing of 32 sites designated crucially important and valuable for immediate acquisition due to their impending loss if action was delayed. This effort was performed in compliance with the second goal of the Advisory Commission as specified in the executive order. The list was completed in September, 1972, from data obtained prior to the development of the Heritage Trust site inventory described below (Georgia Department of Natural Resources, 1974).

The Georgia General Assembly appropriated $12,500,000 to the Heritage Trust Program in April, 1973, for acquisition of lands considered most significant and endangered by the Technical Task Force. An additional $500,000 was secured from federal Land and Water Conservation funds. By the end of fiscal year 1974, expenditures had been made on 22 separate sites totaling 15,409 acres. The Nature Conservancy assisted the Heritage Trust by acquiring options on properties before the state was ready to purchase. When the state did purchase the sites, they acquired lands, through Nature Conservancy options, with a market value of approximately $7,000,000 for only $3,500,000 (Dickson, 1974).

While the first two goals of the Advisory Commission were being met by the Implementation Task Force and the Technical Task Force, the Planning Unit in the Division of Planning and Research (Georgia Department of Natural Resources) worked on the third goal: development of methodology for conducting an inventory and evaluation of resource potentials. The site-based inventory was developed in fiscal years 1972

and 1973. The Planning Unit's 1973 budget was $95,996 (Georgia Department of Natural Resources, 1974).

Since 1974 the Heritage Trust program has coordinated a substantial acquisition program. Twenty-nine sites, totaling 52,851 acres, have been acquired at a combined cost of $25,063,524. Funding sources for the five-year period have been state appropriations (65%), federal grants (23%: Land and Water Conservation Fund and National Oceanic and Atmospheric Administration), private donations (11%: one individual contributed $4,000,000), and local government allocations (1%) (Georgia Department of Natural Resources, 1978).

The fiscal year 1979 budget totals $5,588,524: $823,000 in state appropriations, $2,060,249 in Land and Water Conservation funds (30% of the state's allocation), and $2,705,255 in unencumbered funds from prior years. An allocation of $75,000 of the budget is used for administration of the program (Georgia Department of Natural Resources, 1978).

Staff. Heritage Trust coordinating staff consists of two individuals. The program's primary operations are carried out by personnel in other branches of the Department of Natural Resources.

Inventory methodology. The Georgian inventory exists primarily to generate a priority list of areas deserving protection through acquisition. It is a site-based inventory that was developed in consultation with Charles Augar, a professor at the University of Georgia School of Environmental Design. Augar's prior efforts as a consultant and planner in Minnesota brought about a Minnesota State Legislature mandate that resulted in a two-year study and concluded with a ten-year capital

improvement program. A lecture and slide presentation by Augar originally prompted Governor Carter to create the Heritage Trust. Augar was contracted by the Georgia Department of Natural Resources to guide development of inventory methodology (Pritchard, 1973).

The initial inventory was conducted over a one-year period between October, 1972, and September, 1973. The following developmental information was obtained in the "Phase II Work Plan" reprinted in the Georgia Heritage Trust Ten Year Action Plan (1974).

The first task was the compilation of a Heritage Directory of all key people throughout the state who would be able to contribute information on significant sites. Georgia is divided geographically into eighteen Area Planning and Development Commissions (APDC). Officers, committee chairmen and mailing lists of APDC's, conservation organizations, park and recreation agencies, and related groups were included in the Heritage Directory.

Statewide maps (1:250,000 scale) from the Army Map Service were modified to be used by Heritage Trust staff. The maps were enlarged and divided by APDC regions. Plastic overlays were added for eventual recording of APDC site recommendations, acquired areas, official natural areas, endangered factors, etc.

A survey form was developed to provide the primary means for concerned citizens throughout the state to identify, describe, and recommend the historical, archaeological, and natural resource areas they wanted evaluated. This form provided for indication of the area's name, ownership, location, description, significance, need for protection, and personal evaluation. Separate forms were prepared for each category

of site to be recognized: historical, archaeological, and natural. A procedural guide was published to assist citizens in filling out the forms.

The Heritage Directory was then utilized to organize (by APDC regions) and educate all interested citizens, including professionals, on the objectives of the Heritage Trust. Following a statewide briefing attended by more than 200 individuals, regional workshops were held for each APDC. Members of the Heritage staff were present to conduct the workshops. Survey forms previously submitted were reviewed and additional survey forms were completed to insure that the statewide inventory would be as complete as possible. The workshops were held between January 1 and March 31, 1973.

Regional site nominations were reviewed and screened by Heritage staff. A list was prepared of sites that met Heritage Trust criteria for potential inclusion in the inventory. Criteria utilized included accessibility to population centers and highways, relative cost and availability, surrounding development, basic services present (not applicable to natural sites), site characteristics (topography diversity, unique features, soils, existing water resources), significance (presence of rare natural elements), need, and endangeredness. The APDC regions nominated 575 sites which met these criteria.

During the following summer, the sites deemed most significant were field evaluated by an inspection team consisting of an ecologist-naturalist, park planner, and historian-archaeologist. In specific areas, other personnel were present (marine biologist for coastal zones, forester, river expert, etc.). This evaluation covered vegetation types,

surface water, major fauna types, the presence of rare and endangered species, diversity of flora and fauna, and the overall visual impact. Based upon this evaluation, numerical rankings were assigned each site. The inspection team visited more than 200 sites in a four-month period.

Using the field evaluation forms and a complex methodology of prioritization (see Pritchard, 1973, and Georgia Department of Natural Resources, 1974), the Advisory Commission and Technical Task Force developed a priority listing of sites approved for state acquisition.

All survey forms, maps, field evaluation forms, and other existing records were put on file in the Georgia Heritage Trust office in Atlanta. As survey forms are received nominating new sites, they are evaluated by the Technical Task Force; information is gathered from various state agencies and a decision made on whether or not to field evaluate the area.

Utility. Heritage Trust inventory data supports a well-funded and successful state program in land acquisition for conservation and recreational purposes. Based on the data, a system of priority ranking has been established that allows cultural, historic, and natural sites to be simultaneously evaluated.

The inventory is limited to providing information on sites that have been previously judged important; there appears to be no utilization of inventory data for environmental impact review, aiding land management planning, identification of endangered and threatened species habitat, etc.

Discussion. The Georgia Heritage Trust inventory was established with significant public involvement. Data is continuing to be utilized by an aggressive acquisition program. While the program was created and early development strongly supported by then Governor Carter, the Heritage Trust Program has continued to enjoy popular and governmental support under the administration of Governor Busbee.

The usefulness of inventory data is limited to establishing priorities for land acquisition. Although field evaluations are completed on a significant percentage of nominated sites, the quality and adequacy of data gained from an inspection team that visits 200 sites in 120 days is questionable.

The assistance of The Nature Conservancy in Georgian land acquisition led Governor Carter to recommend the Conservancy to the Governor of South Carolina to assist that state in establishing a South Carolina Heritage Trust. The Nature Conservancy subsequently established the country's first element-based state natural heritage inventory in South Carolina in 1974 (Sanders, 1978).

Illinois Natural Areas Inventory

Program objective. The Illinois inventory was a three-year project to find, evaluate, describe, and classify natural areas for the Illinois Department of Conservation. The purpose was to provide accurate and detailed information on the location and characteristics of natural areas of statewide significance. The term natural area refers to any area listed by the inventory, but many are not undisturbed sites. Natural areas were included in the inventory if they met one or more of the following criteria:

Category I: Ecological areas. These areas have terrestrial or wetland natural communities that are relatively undisturbed so that they reflect as nearly as possible the natural condition at the time of settlement in the early 1800's.

Category II: Endangered species habitats. These sites have animals or plants that are in danger of extirpation from Illinois.

Category III: Relict species habitats. Sites with outstanding assemblages of plants that have persisted from a past climatic period were listed as relict species habitats.

Category IV: Geologic areas. Localities that are outstanding representatives of the state's geologic diversity were listed in this category.

Category V: Natural study areas. Lands that are managed and used as natural areas for teaching and research or as nature preserves were included as natural study areas.

Category VI: Unique natural areas: A few significant natural areas did not fit into any of the above categories. These are sites of unique natural features, which are often small areas with unusual biological features, such as a cave with an unusual assemblage of invertebrate animals.

Category VII: Aquatic areas. Some streams and lakes were listed as natural areas because they are relatively natural habitats for native aquatic life (White, 1978)

Relation to state government. The Illinois Natural Area Inventory was performed under contract to the Illinois Department of Conservation by the Department of Landscape Architecture, University of Illinois, Urbana-Champaign; and the Natural Land Institute, Rockford, Illinois. Currently, the inventory data is managed by the Natural Areas Section in the Division of Land and Historic Sites of the Department of Conservation (White, 1978).

History and funding. The inventory program was initiated by the state legislature through a citizen initiative bill. The legislature appropriated $327,000 of state general revenue, which was matched by a

Land and Water Conservation Fund grant, in support of the three-year inventory development contract with the University of Illinois. Pilot studies began in March, 1975, and a final summary report was published in November, 1978 (Schwegman, personal communication, 1979).

Staff. The inventory employed five field ecologists, seven field assistants, and a technical staff that assisted and directed the field workers. There were an additional five consultants, two administrative personnel, and several data system specialists with the program (White, 1978).

Inventory methodology. While the Illinois inventory resulted in the recognition of natural area sites, site selection was based on the occurrences of elements of natural diversity; the survey can be considered an element-based inventory. The following information on inventory methods was obtained in the Summary Report, Illinois Natural Areas Inventory (1978).

Similar to a Nature Conservancy natural heritage program, the first action taken by the Illinois program was the compilation of available information on the state's natural diversity. Museum and herbarium records were searched, research files and literature reviewed, and unpublished reports and similar materials gathered from the Illinois Nature Preserves Commission, Department of Conservation, Natural History Survey, and the universities. More than 1,400 published references to biologically significant areas in Illinois were assembled. Professionals such as District Foresters and District Soil Conservationists in each county were asked to contribute any available information on potential

natural areas. Other people considered knowledgeable, especially faculty members at colleges and universities, were contacted. To generate information from the public, staff presented 27 talks across the state, reaching an estimated 2,000 people. In addition, taped radio spots were distributed to 80 stations, a television presentation was aired, and articles were released in newspapers and local newsletters.

Maps and aerial photos were then studied for each county to select and classify potential natural areas. The emphasis of the Illinois inventory was on searching for relatively undisturbed natural communities. These sites were classified under Category I: Ecological areas (see complete category list on page 65). Examination of Agricultural Stabilization and Conservation Service (ASCS) black and white aerial photographs (1:20,000 scale) allowed staff to eliminate disturbed areas from consideration. Resolution of the photographs was sufficient to discern high quality sites. Approximately 73% of the potential ecological sites were identified in this manner. Photograph analysis was much less useful in identifying sites that qualified for inclusion in the inventory under the other six classification categories. Visual observation of areas from light aircraft (aerial survey) was utilized to confirm site selection from the map and photograph analysis.

Sites chosen from the evaluation of assembled natural area information, aerial photograph analysis, and aerial surveys became the object of initial ground surveys. These surveys were completed in the fall, winter, and spring to leave summer months for the final field work. In the initial ground surveys, sites selected during prior inventory stages were evaluated to check accuracy of the map and photo examination and

develop techniques for the final field survey. Two-thirds of the potential areas in a typical county were rejected during the initial ground survey. Initial surveys were not made of endangered and relict species sites; these were small areas that had to be searched during spring and summer months. The Illinois inventory recognized sites under the endangered and relict species categories, even if there was only one extant species present.

The final evaluation, description, and classification of each natural area was completed in a final field survey. The boundaries of the natural area were drawn on a topographic map, vegetation was sampled, and checklists were completed for amphibians, reptiles, birds, mammals, ferns, trees, and shrubs. All relevant information was compiled on a main data form. The Illinois main data form provides for the following information items, although all areas were not visited and consequently less information was recorded:

Basic Information
- Name of area
- Significant feature: the reason why a natural area was identified
- Exceptional feature: a feature that adds to the preservation value of a natural area
- Topographic map with boundaries of natural area
- Aerial photo with overlays showing the location and boundaries of features within the natural area

Location
- County
- Township and range
- Section and subdivisions of the section, to the nearest quarter-quarter section
- Topographic map

Natural Characteristics
- Altitude: minimum and maximum
- Topography: physiographic unit, major topographic feature, and individual topographic feature

Natural Characteristics (continued)
- Geologic formation
- Soil association
- Natural community classification
- Natural quality: acreage of each natural community in each natural quality grade; description of natural quality
- Acreage of natural area
- Plant community: for each natural community

Legal Status and Use
- Ownership
- Use of natural area and surrounding land
- Management needs
- Actual or potential management facility
- Preservation status
- Threat of destruction

Discussion of Preservation Values

Supplemental Materials
- Species lists
- Vegetation sampling data
- Literature citations (White, 1978)

A computer-based system was developed to store, retrieve, and analyze this information. A minicomputer was purchased that permits conditional searching of the data base, priority ranking of natural areas based on specific data elements, and formatted report-like output of statistical analyses or a tabulation of the data.

The inventory identified a total of 1,089 sites. These natural areas contain 1,730 significant features (element occurrences in Nature Conservancy terminology). A majority of the sites identified (610) were Category I, high quality natural communities. Those areas recognized on the basis of existing endangered species totaled 269.

Utility. The Illinois Department of Conservation and Illinois Nature Preserves Commission are using inventory data to develop and implement a plan for identifying the needs and means for preserving natural areas.

All Illinois multi-county and county planning agencies have received a data summary report from the Natural Areas Section. Similarly, reports have been sent to all conservation and forest preserve districts. Complete inventory files have been provided to the Illinois Department of Transportation, Division of Water Resources, and Environmental Analysis Section of the Department of Conservation. The Nature Conservancy and the National Land Institute have been provided with prioritized lists of privately held areas of significance. Other information has been supplied to the U.S. Forest Service, U.S. Fish and Wildlife Service, Corps of Engineers, and U.S. Army (Schwegman, personal communication, 1979).

The Illinois Natural Areas Inventory has allowed the Department of Conservation to advise federal and local land management agencies, perform facilitated Environmental Impact Statement reviews, and pursue land acquisition and other negotiations with private landowners (Schwegman, personal communication, 1979).

Discussion. The comprehensive scope of the Illinois Natural Areas Inventory has allowed stored data to be utilized in the same manner as information within a standard element-based inventory. The Illinois inventory relied heavily on photo-interpretation, aerial surveys, and field evaluation. These activities added significantly to the results of the inventory; if the inventory had relied solely on available information from secondary sources, 71% of the ecological sites and 17% of the occurrences of endangered and relict species would have been overlooked (White, 1978). The three-year inventory was relatively costly, with an annual average budget of $218,000 (Schwegman, personal communication, 1979).

The inventory contract liason officer and present chief of the Natural Areas Section, John Schwegman (personal communication, 1979), states that photo-interpretation within the inventory was designed primarily for evaluating prairie lands and stands of deciduous trees. Schwegman is not enthusiastic about the potential for adapting survey techniques for use in mountainous western states such as Colorado or Montana.

Regardless of inventory methodology, Schwegman (personal communication, 1979) recommends that any state considering the development of a natural heritage inventory be very open and go to the public and federal agencies at the outset for support. He cites the manner in which Colorado recently launched its program as a model. Schwegman is currently working on achieving the broad-based support necessary to expand the natural areas program to take full advantage of the completed inventory.

Wisconsin Scientific Areas Program

Program objective. The goal of the scientific areas program is the preservation of sufficient scientific areas and other natural areas in each region of the state to provide examples of all types of biotic communities and other significant natural features native to the region. The program has placed high priority on completing natural area inventories in all the counties of Wisconsin. These site-based inventories have been completed in about half of the counties thus far. Features that are recognized in the inventories are: 1) terrestrial and aquatic plant communities in an essentially undisturbed state; 2) significant

geological features and archaeological features; and 3) sites which provide habitat for endangered plants or animals. Natural areas that are identified in the inventory, managed for preservation, and formally designated by the Wisconsin Scientific Areas Council become state scientific areas. These scientific areas are maintained primarily as biotic sanctuaries and areas for scientific research and the teaching of conservation and natural sciences. They are not intended for intensive recreational use (Germain et al., 1977).

Relation to state government. The scientific areas program is located within and as a part of the Department of Natural Resources.

History and funding. In response to the efforts of a group of conservation leaders, the Wisconsin legislature created the first state-recognized preservation program in the nation by establishing the Scientific Areas Preservation Council in 1951. This advisory council to the Department of Natural Resources was to identify, evaluate, and recommend sites for acquisition, and take other action as appropriate to establish a state scientific area system. In 1965 the state budget included the first appropriation of funds for a full-time staff to coordinate the program. Beginning in 1971, a small appropriation designed specifically for the acquisition of scientific areas was made. This annual acquisition fund has since grown to its present size of about $200,000 (Germain, personal communication, 1979).

The approximate annual cost of administering the scientific areas program, aside from inventory activities, is $54,000. This figure does not include office rent, secretarial help, and other support services of

the Department of Natural Resources (Germain, personal communication, 1979).

Staff. The Wisconsin Scientific Areas Program has three full-time staff members including a coordinator, a scientific area use and management overseer, and an inventory director. Four half-time summer field assistants are hired (Germain, personal communication, 1979).

Inventory methodology. Staff of the Wisconsin Scientific Areas Program have been involved with inventory activities for nearly ten years. After surveying 25 counties in seven years, the inventory methodology was streamlined in 1977, such that the remaining 47 counties could be evaluated before 1981. The following methodology represents the modified process Wisconsin developed, as explained by program coordinator Clifford Germain (personal communication, 1979). Wisconsin's methodology closely resembles that of the Illinois Natural Area Inventory; the states have consulted with one another.

First, all known resource information on the study area is gathered from a literature search, personal communication, and a review of museum and herbarium records for rare species data. Assembled data is recorded on 7½ minute USGS topographic maps.

Secondly, ASCS aerial photographs are studied for the presence of potential natural areas. Any areas noted are mapped on the maps used in the first step. This evaluation provides leads on areas that have remained relatively undisturbed, a major emphasis of the Wisconsin program. Searches for representative examples of biotic communities and habitats of rare species are accomplished in the following step, field evaluation.

Areas selected by the first two steps are field evaluated. In regions where too many potential areas have been identified for individual checking, an aerial reconnaissance may be performed to eliminate poor candidate sites. Data collection and observations in the field evaluation emphasize species present, distribution and abundance of native vegetation, presence of rare species, and types of disturbance. Due to time and budget restraints, field examinations last two to three hours on the better sites.

In the last phase of the inventory, the identified natural areas are given a final ranking of significance, and an implementation plan is developed for the preservation of the most significant natural areas (see Tans, 1974). Regardless of whether or not an identified natural area is ever protected and designated a state scientific area, data on the area is stored in the Department of Natural Resource's computer. Information stored includes site name, an identification of the site's primary vegetation type, the significance of the site, name of the drainage basin, physiographic region, land-controlling agency, quadrangle map, latitude and longitude, legal description, and size. When available, additional information is stored for each natural area, e.g., plant list, breeding bird census, and established photographic points. More than 1,500 natural areas have been recognized by the Wisconsin inventory; 145 of these have gained legal protection and have been formally designated as Wisconsin scientific areas.

Utility. The natural area inventory in Wisconsin has been used in a variety of ways. The inventory has allowed the Wisconsin Scientific Areas Program to select the best remaining areas in the state for

inclusion in their scientific areas registry; protection efforts and funds can be efficiently focused. The inventory has provided for expanded use of identified areas for education and scientific research. In 1971 formal educational use of state scientific areas was reported by 23 midwest universities involving 1,700 students. At that time, 65 research projects were reported in progress. A 1975 survey indicated that statewide use of scientific areas for research, class teaching and demonstration, bird and plant inventory, or other natural science-oriented educational activities had doubled between the years 1971 and 1975 (Germain et al., 1977).

Under Wisconsin Statutes, the Scientific Areas Preservation Council is responsible for reviewing all applications to modify navigable waters. The applications are screened to identify potential direct or indirect impact on natural areas. Over the past four years, the Council has reviewed more than 1,000 applications for permits to construct ponds, channels, or other alterations involving lands adjoining navigable waters (Germain et al., 1977).

Requests for inventory data are regularly received from local, state, and federal agencies. Private consulting firms, public utility companies, and regional planning commissions utilize inventory data. A summary report describing recognized natural areas is sent to all these groups; specific requests are answered through personal communication (Germain, personal communication, 1979).

Discussion. The site-based inventory developed by the Wisconsin Scientific Areas Program has helped create one of the most comprehensive state natural area systems in the country. More than 145 sites are

included in the system, and total acreage protected is approximately 20,000 acres (Germain, personal communication, 1979).

The inventory has been conducted recently under tight budget restraints. The short field evaluation time (two to three hours per site) is recognized by the program staff as one of the weaker links in the survey; more time should be spent at each site and areas visited at different seasons. If funds are available, an attempt will be made to update the Wisconsin inventory every five years (Germain, personal communication, 1979).

The state of Wisconsin was approached by The Nature Conservancy in 1978 with a proposal to develop a natural heritage program. The state did not accept the proposal because the scientific areas inventory of the state was scheduled for completion within a few years, and all previous data had been collected primarily by the same two individuals; the addition of Nature Conservancy staff would possibly jeopardize data quality and uniformity (Germain, personal communication, 1979).

The Scientific Areas Program coordinator Clifford Germain (personal communication, 1979) suggests that states which have not previously developed an inventory program would probably be best served by contracting with The Nature Conservancy. Germain was consulted by the Colorado Department of Natural Resources in their deliberations on contracting with The Nature Conservancy. Germain recommended that The Nature Conservancy package be bought but that the element inventory be built gradually so as not to slight ongoing natural area designation and protection efforts (Pustmueller, personal communication, 1979).

Chapter 4

THE MONTANA SITUATION

Departmental Concerns

Several departments within Montana State government have demonstrated an interest in the development of a comprehensive natural heritage inventory. The Departments of State Lands, Fish and Game, and Natural Resources and Conservation have specific needs that potentially could be met by appropriate development of a natural heritage inventory. The respective needs of each department are discussed below.

The Department of State Lands has charge of "the selecting, exchange, classification, appraisal, leasing, management, sales, or other disposition of the state lands" (Section 77-1-301 M.C.A. 1978). One function of the Department, which has resulted in an interest in some form of heritage inventory, is the responsibility for leasing in the best interest of the state any state lands for mining, selling, and disposing of coal (Section 77-3-301 M.C.A. 1978). Pursuant to the provisions of the federal Surface Mining Control and Reclamation Act (SMCRA) of 1977 (30 U.S.C. 1201), the Department of State Lands must establish a state regulatory program for surface coal mining that includes an inventory system capable of designating areas unsuitable for mining. This task has been undertaken by the Reclamation Division of the Department of State Lands.

The Surface Mining Control and Reclamation Act represented the culmination of extended efforts by the federal government to establish

appropriate standards to minimize the social, economic, and environmental effects of surface mining. The need for enacting proper standards was made more urgent by the Carter Administration's decision to promote the expansion of coal mining to meet the nation's energy demand. The Act sets strict performance standards and reclamation procedures that must be followed by all surface mining coal operations. Furthermore, the statute recognizes that certain lands are not suitable for surface mining and establishes criteria identifying those lands.

To assume regulatory authority under the Act, each state must establish:

> a planning process enabling objective decisions based upon competent and scientifically sound data and information as to which, if any, land areas of a State are unsuitable for all or certain types of surface coal mining operations (Section 522(a)(1)).

Lands where reclamation pursuant to the requirements of the Act is not technologically and economically feasible are to be designated unsuitable. Other discretionary designations may be made by regulatory authority on lands where mining operations would:

> (A) be incompatible with existing State or local land use plans or programs; or
>
> (B) affect fragile or historic lands in which such operations could result in significant damage to important historic, cultural, scientific, and esthetic values and systems; or
>
> (C) affect renewable resource lands in which such operations could result in a substantial loss or reduction of long-range productivity of water supply or of food or fiber products, and such lands to include aquifers and aquifer recharge areas; or
>
> (D) affect natural hazard lands in which such operations could substantially endanger life and property, such lands to include areas subject to frequent flooding and areas of unstable geology (Section 522(a)(3)).

Each state planning process must include:

> a data base and an inventory system which will permit proper evaluation of the capacity of different land areas of the state to support and permit reclamation of surface coal mining operations (Section 522(a)(4)).

Substantial federal appropriations were made to the Secretary of Interior to implement the regulatory functions of the Surface Mining Control and Reclamation Act. Under Sections 705 and 712 of the Act, the Secretary is authorized to make annual grants to states for administrating and enforcing their programs from an annual budget of $30,000,000 for fiscal years 1979 and 1980 and from such funds as are required thereafter. In order to receive a permanent regulatory program grant, each state must have an approved state regulatory program.

The Act originally required that states must submit their regulatory program plans for federal approval by April 3, 1979. However, an extension was granted to the states by the Secretary of Interior, and program plans may be submitted through August 3, 1979. At that time, to comply with Section 522 of the Act, the Department of State Lands must be able to demonstrate that it has developed or is developing a data base and inventory system capable of determining lands unsuitable for surface coal mining.

In accordance with the Act, the inventory system must have the capacity to catalog sites of historic, cultural, and scientific value and identify lands where the value of existing renewable resources is high and those areas subject to frequent flooding and unstable geology. Furthermore, the inventory must include data on known coal deposits for economic considerations (depth, thickness, and quality). Since a classical Nature Conservancy natural heritage inventory only identifies

those elements of scientific value, the Department of State Lands has three options for inventory development: 1) design and implement their own system tailored to the requirements of the Surface Mining Act; 2) contract the entire job to a private consulting firm; or 3) contract with The Nature Conservancy and modify their methodology to conform with the data requirements of the Act (Juntunen, personal communication, 1979).

The Department has tentatively decided to design and coordinate the development of an inventory system. The costs of contracting the entire project to a private consulting firm is prohibitive. In 1978 a North Dakota consulting firm made a bid to the state of Wyoming for the development of their surface mining data system in excess of $500,000 (Minier, personal communication, 1979). The scope of The Nature Conservancy inventory has been judged to be too limited, in relation to what has to be catalogued under the provisions of the Surface Mining Act. The Department feels at this time that it would be more beneficial and economical to design their own inventory. The Department will therefore initiate inventory development. The Nature Conservancy may be contracted to perform certain phases of this development and to lend expertise if problems arise. Montana lands to be covered by the Department's inventory are all private and state lands east of the continental divide (Juntunen, personal communication, 1979).

Although the scope of the inventory required by the federal Surface Mining Act would be broader than a conventional natural heritage inventory, its implementation would similarly facilitate the preparation of Environmental Impact Statements as required by the Montana Environmental Policy Act (MEPA) of 1977 (Section 75-1-101 et seq. M.C.A. 1978).

This Act is a state version of the National Environmental Policy Act which requires all state agencies to prepare an Environmental Impact Statement for:

> every recommendation or report on proposals for projects, programs, legislation, and other major actions of state government significantly affecting the quality of the human environment (Section 75-1-201).

A Preliminary Environmental Report (PER) is required to be written by the guidelines established under MEPA to determine whether the proposed state action necessitates the drafting of an Environmental Impact Statement. Preliminary Environmental Reports and Environmental Impact Statements must document existing vegetation and wildlife and describe the potential impact of the proposed action on the biological communities. The Department of State Lands has written either a Preliminary Environmental Report or an Environmental Impact Statement on each of the coal mining permits they have granted since MEPA was enacted. Ten permits were granted each year in 1977 and 1978 (Juntunen, personal communication, 1979). Any state inventory that includes natural heritage features, whether it is developed by the Department of State Lands or another state agency, would facilitate the accurate documentation of potential impacts required by MEPA.

The Department of Fish and Game has examined the utility of natural heritage inventories primarily through its Parks Division interest in identifying and conserving state lands of scientific significance. The Parks Division administers the State Park System:

> for the purpose of conserving the scenic, historic, archaeologic, scientific, and recreational resources of the state and providing for their use and enjoyment, thereby contributing to the cultural, recreational, and economic life of the people and their health . . . (Section 23-1-101 M.C.A. 1978)

To aid in the achievement of this mandage, Section 23-1-102 of the Montana Code Annotated provides that the Department of Fish and Game:

> may by purchase, lease, agreement, acceptance of donations, or condemnation acquire for the state any areas, sites, or objects which in its opinion should be held, improved, and maintained as state parks, state recreational sites, state monuments, or state historical sites.

The 1978 Montana Statewide Comprehensive Outdoor Recreation Plan (SCORP) indicates the Parks Division concern towards preserving scientific resources. The plan identifies scientific resources as those areas with significant ecological, geological, paleontological, or biological values. G. Wesley Burnett, Chief of the Parks Division Planning Bureau, has stated (personal communication, 1979) that "significant" scientific resources can be considered those lands that: 1) have been the focus of scientific study in the past, e.g., remains of Cretaceous mammals at Purgatory Hill and the rare fungal/grass association within Missouri Headwaters State Park; 2) have the potential to contribute to future scientific research, e.g., examples of native plant communities not preserved elsewhere in the state; or 3) contain interpretative examples for the public of a process of science, e.g., the Lewis and Clark Caverns.

In the past, there were few reasons for the Parks Division to undertake an inventory of the state's scientific resources, for there have been few funds available to protect the significant areas. Since matching federal funds have become available through the Land and Water Conservation Fund, the Parks Division has reason to identify lands deserving protection. It is recognized that land development in the state has escalated to a point where many lands containing scientific resources are threatened. In fiscal year 1978, Montana received

$2,972,059 through the Land and Water Conservation Fund. Of this amount, $1,242,927 was spent on acquisition of lands with value for recreation and wildlife or containing cultural and scientific resources. The fiscal year 1979 federal allocation was $3,147,163 (Burnett, personal communication, 1979).

The development of a state natural heritage inventory that included those scientific resources the Parks Division deems significant would allow a priority ranking to be given to lands for potential state purchase or leasing. A system for quantifying the recreational potential of lands has been established and an inventory completed on most of the 5,129,000 acres owned by the state of Montana (Burnett and Conklin, 1979). G. Wesly Burnett and David Conklin of the Parks Division now recognize the need to either expand this inventory system, develop another system, or contract with The Nature Conservancy to identify existing scientific resources. Specifically, the features that the Parks Division desires to be catalogued are native plant communities, unusual ecological associations, critical habitat of wildlife, the location of endangered and threatened species, major paleontological sites, and geological features with interpretive/educational value (Burnett, personal communication, 1979).

The inventory system that the Department of State Lands develops for eastern Montana coal lands will partially accomplish the Parks Division goal of identifying scientific resources. Consequently, the Planning Bureau of the Parks Division is assisting the Department of State Lands in developing this inventory (Juntunen, 1979). Simultaneously, the Planning Bureau will continue to research the potential of

different natural heritage inventory methodologies for fulfilling the Parks Division desire to establish a priority ranking for acquisition of lands throughout Montana.

A third state agency that shares an interest in the initiation of a Montana natural heritage inventory is the Department of Natural Resources and Conservation (DNRC). The Department was created by the Executive Reorganization Act of 1971, comprising the Divisions of Forestry, Water Resources, Oil and Gas Conservation, Conservation Districts, and Energy. Several functions of the Department would benefit from the existence of a natural heritage inventory program.

The Division of Energy is responsible for administering the Montana Major Facility Siting Act of 1973 (Section 17-20-101 et seq. M.C.A. 1978). This Act requires that a certificate of environmental compatibility and public need be issued before an energy transmission or energy conversion facility is constructed. Pipelines capable of transporting gas, water, or liquid hydrocarbon products that are associated with a major facility are subject to review pursuant to the Act (Kuntz, 1979). The issuance of the certificate is necessary:

> to ensure that the location, construction, and operation of power and energy conversion facilities will produce minimal adverse effects on the environment and upon the citizens of this state . . . (Section 75-20-102)

The study, evaluation, and report on each proposed facility is conducted by the Division of Energy with assistance by other state agencies having expertise relating to the impact of the construction. Environmental factors that must be considered in the review process include effects on natural systems, wildlife, plant life, and unique or otherwise significant ecosystems (Section 75-20-503). Since May, 1973, there have been

20 Siting Act applications reviewed and certified. Four applications are in the process of being reviewed (Kuntz, 1979). Often the application review for environmental compatibility is accompanied by compilation of a Preliminary Environmental Report and/or Environmental Impact Statement as required by MEPA. The Department is currently preparing an Environmental Impact Statement on the proposed Northern Tier Pipeline (Thompson, personal communication, 1979).

Presently, environmental review is conducted on a site-by-site basis by field representatives of the DNRC. The consolidation of relevant information and existing research into a single office, housing a natural heritage inventory, would streamline the review process by reducing the Department's dependence on field representatives (Culver, personal communication, 1979).

Administration of state-owned forests by the DNRC involves several activities that a natural heritage inventory would supplement. Lands that are classified by the Department of State Lands as being principally valuable for timber are managed by the Forest Division of the DNRC. These lands have been grouped into seven designated State Forests.

The Forestry Division manages the State Forests under a multiple-use policy that gives consideration to conservation, defined as the protection and wise use of forest, forest range, forest water, and forest soil resources for the common welfare of the people of Montana (Section 76-13-102 M.C.A. 1978). In accordance with this multiple-use policy, the Forestry Division has begun to draft Land Use Management Plans for each of the State Forests. The Swan River State Forest Plan was completed in 1978, three management plans are currently being developed, and

the remaining plans will be completed within ten years. The Land Use Management Plans identify soil types, plant communities, wildlife habitat, water resources, and potential natural areas (Salmonson, personal communication, 1979). A natural heritage inventory would provide data necessary to complete these plans (Wetzel, personal communication, 1979).

Preliminary Environmental Reviews and/or Environmental Impact Statements are written by the Forestry Division on all state timber sales in excess of 100,000 board feet (Salmonson, personal communication, 1979). Future environmental reviews of proposed timber sales would constitute another use of a natural heritage inventory by the DNRC.

The Department of Natural Resources and Conservation recognizes the utility that a statewide natural heritage inventory would have among its activities in administering the Major Facility Siting Act and managing state forests. However, the Department presently lacks funds to contribute to inventory development. The primary role of the Department will therefore be one of assisting and encouraging the Departments of State Lands and Fish and Game in their efforts towards inventory development.

In conclusion, several departments of Montana State government perform actions that would be facilitated by the development of a natural heritage inventory. The Department of State Lands has tentatively decided to design an inventory with a broader scope than conventional natural heritage systems for immediate use in determining lands unsuitable for coal mining in eastern Montana. The Department of Fish and Game is currently examining inventory methodologies that could supplement the Department of State Lands efforts and provide information on scientific resources throughout the state. The Department of Natural Resources

conducts several review functions that would be facilitated by a natural heritage inventory.

Chapter 5

RECOMMENDATIONS FOR MONTANA

Based on my review of state inventory programs and an interpretation of the current needs of Montana State government, I have formulated the following recommendations for Montana inventory development. Implementing a state natural heritage inventory, especially an expanded inventory that will serve the needs of the Department of State Lands, will require sound program coordination, interagency cooperation, public involvement, and adequate funding. The combined effort should ideally result in the best possible inventory program for Montana; the purpose of the following recommendations is the achievement of that goal.

1) The Nature Conservancy should be contracted to help develop and implement the inventory, particularly data recording and storage methodologies. Nature Conservancy inventory programs are working smoothly and efficiently in eighteen states. Staff personnel in the seven programs I reviewed (a majority are state employees independent of The Nature Conservancy) are enthusiastically supportive of the established methodology. Two of the three states reviewed with individually-designed programs have specifically recommended that states contract inventory development with The Nature Conservancy.

The Nature Conservancy has the professional expertise to successfully complete a comprehensive inventory. The Strip Mining Bureau and Parks Division do not have personnel available to undertake such a

project; much of the work will have to be contracted to professionals. This process will be facilitated by obtaining the assistance of The Nature Conservancy.

A program in Montana that The Nature Conservancy helped develop would have a far greater chance of being compatible with other state heritage inventories than a program individually designed by the state. As additional states implement natural heritage inventories, the potential for valuable exchange of inventory data grows.

The Department of State Lands would have to codevelop the Montana inventory with The Nature Conservancy to insure that the resources addressed by the Surface Mining Act can be processed by the data system. Many of these resources have been included in Conservancy heritage programs elsewhere: archaeological sites (Tennessee), paleontological beds (New Mexico and Mississippi), historical sites (Tennessee), and soils (Colorado). Further cooperation will be necessary to insure state and federal goals are addressed by the inventory. Any system codeveloped by The Nature Conservancy and the state should have a software program that can be integrated with the computer facility the state determines to be most convenient and accessible. Manual reference files receive a great deal of use among existing natural heritage programs. Emphasis should be placed on establishing organized and durable map, geographical, and directory record files (see Oregon review).

2) A comprehensive statewide inventory should be developed. The inventories that have been reviewed provide valuable services for the respective state governments. Given the identified needs of the departments of Montana State government, a comprehensive inventory would be

utilized for designating lands unsuitable for surface coal mining, Environmental Impact Statement review, facility siting application review, priority ranking of state lands of scientific significance for acquisition purposes, and management of state forests. Implementing an inventory of eastern Montana would provide for designation of unsuitable coal lands, but place severe restrictions on all other applications. Western Montana should be surveyed simultaneously. The overall cost to the state of this approach would undoubtedly be less than surveying eastern Montana now and completing work west of the divide at a later date. The Wisconsin Scientific Areas Program started with this approach, surveying a few counties at a time and building the range of their inventory gradually. Then it became apparent that the last county would not be surveyed until after 1990. Before the inventory ever ascertained what resources were present, they could become impacted or destroyed. Wisconsin has streamlined its program; the inventory will be completed by 1981. Montana should follow Wisconsin's experience and implement a statewide inventory. Significant natural heritage features could be lost from western Montana before they were ever recognized.

3) The Departments of State Lands, Fish and Game, and Natural Resources and Conservation should work closely to determine the objectives and goals of the inventory program. Decisions have to be made on exactly what resources will be recognized by the inventory. The Department of State Lands will assume a lead role in these discussions, as the inventory should satisfy the requirements of the federal Surface Mining Act. However, the eventual utility of the inventory will also depend on how well it is designed to satisfy needs of the Departments of Fish and

Game and Natural Resources and Conservation. In the inventory planning process, adequate time should be allocated to complete inventory development. Several state program directors have stated that a minimum of 18 months is required for development before the inventory is fully operational. Timing of inventory initiation can influence the length of the developmental period. The process is facilitated if data storage methodology is organized in the winter such that it is ready for data input by the first summer field season (Olsen, personal communication, 1979).

4) Federal land management agencies should become involved in inventory planning. States with both Nature Conservancy programs and individually-designed inventories emphasize that these agencies are major users of their programs. The Montana experience should be no different, as approximately 30% of the state is federally-owned. The Colorado Natural Areas Program can be consulted on how federal cooperation could be obtained. That state brought representatives of the Bureau of Land Management, U.S. Forest Service, and U.S. Fish and Wildlife Service together for an inventory planning workshop. Resulting cooperation and funding arrangements have benefited all participating agencies. Inventory goals, element classification, and data methodology should be refined to accommodate federal needs. Intergovernmental cooperation will help avoid needless duplication of work projects. For example, the Heritage Conservation and Recreation Service is currently funding National Natural Landmark investigations in Montana; the data from these surveys could be utilized in a Montana natural heritage inventory.

5) Supplementary funding sources should be sought to give the inventory program broad-based support. Providing that the entire state

is covered by the inventory, funding in addition to federal grants from the Office of Surface Mining will be required. If the inventory is tailored to the needs of the Department of Fish and Game and federal land management agencies, an allocation of the state's share of the Land and Water Conservation Fund and contributions by the U.S. Forest Service and Bureau of Land Management are conceivable. Depending on the utility of the completed inventory to The Nature Conservancy (a function of their role in designing the inventory), the organization may donate private funds. Once the inventory methodology is established and secondary source information gathered, adequate time and budget should be allocated to record and store the backlog of data that will accumulate; initial funding should not only be secured, but maintenance support as well.

6) The support of professionals with related expertise should be solicited early for assistance in directing inventory implementation. If knowledgeable individuals of the academic community and government are involved directly with design of classification systems, directing literature searches, etc., they will share a vested interest in the program and a desire to see it succeed. Several state inventory programs have formed academic advisory councils to oversee implementation. Contact with the most knowledgeable people in each field will allow inventory personnel to quickly determine where gaps in research and available information exist; planning priorities can be established and action taken, if possible, to fill those gaps. Identifying and contacting the key resource people in the dozen or so areas addressed by the inventory will be a major task but, if accomplished early, could greatly facilitate implementation.

There are natural heritage features that may be addressed by the inventory for which no locational information exists. The distribution of native plant communities in eastern Montana and Montana endangered and threatened plant species have been the subject of few studies. In these areas, inventory personnel in Montana may want to encourage the kind of volunteer effort that emerged in Oregon six years ago to study Oregon endangered and threatened plant species (see Siddall, 1978). Starting from a core group of a few individuals, the group now involves more than 250 amateur and professional botanists that regularly monitor and update a list of 600 plant species.

7) The gathering of information on resources to be included in the inventory should be as comprehensive as possible. Public involvement in this process will not only add to the thoroughness of data collection, but will create public awareness of the program's objectives. The information gathering techniques of Oregon, Georgia, and Illinois should be reviewed for potential use in Montana.

This study has focused on the natural heritage inventory. One must be reminded that the inventory is not an end in itself. The inventory is simply a reference tool. If there is one identifiable end, to which this tool is used, it is the preservation of natural diversity. With natural heritage inventories, the preservation of natural diversity does not have to occur at the expense of growth and land development. Using the inventories as reference, growth may be channeled to the least environmentally destructive paths. The elements that comprise natural

diversity can be preserved for their potential utility and aesthetic qualities. A statement attributed to Aldo Leopold seems appropriate: "The first prerequisite of intelligent tinkering is to save all the pieces."

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